SECTION-2

2.01 — 2.99

COMMUNICATIONS

ALLIED STANDARD FREQUENCY TABLE

SUPER HIGH FREQUENCY (MICRO-WAVE)	3000 - 30,000 Mcs.
ULTRA HIGH FREQUENCY	300 - 3,000 Mcs.
VERY HIGH FREQUENCY	30 - 300 Mcs.
HIGH FREQUENCY	3 -30 Mcs.
MEDIUM FREQUENCY	0.3 - 3 Mcs. (300-3000 Kcs.)
LOW FREQUENCY	0.03 - 0.3 Mcs. (30-300 Kcs.)
VERY LOW FREQUENCY	0.01 - 0.03 Mcs. (10-30 Kcs.)

Frequency bands of Radio Communications Stations do not fall exactly into the breakdown listed above. Also, it is impossible to determine exact frequencies by means of photographic interpretation alone.

To prevent confusion, the following system is used in this report:

If it is thought that the frequency band of a station overlaps the divisions listed in the standard breakdown, the dominant frequency will dictate the frequency band as called for in the above table.

For example, if a transmitter will operate from 300 to 600 Kcs., it will be called "Medium Frequency" for purposes of classification because 3/4 of this frequency band of 400 Kcs. (or 300 Kcs.) falls into the standard "Medium Frequency" division.

Many standardized Japanese Communication Centers, utilizing three 75 foot high steel lattice masts, are believed to fall in this catagory. They may be more exactly referred to as being fairly powerful Low-Medium Frequency stations with reliable ranges of greater than 500 miles.

When a station is catalogued as being of a certain frequency, the classification also presumes the possibility of another transmitter being present, operating at higher frequencies. However, the general classification of the station is still derived by an estimate of its dominant lowest frequency.

[redacted]

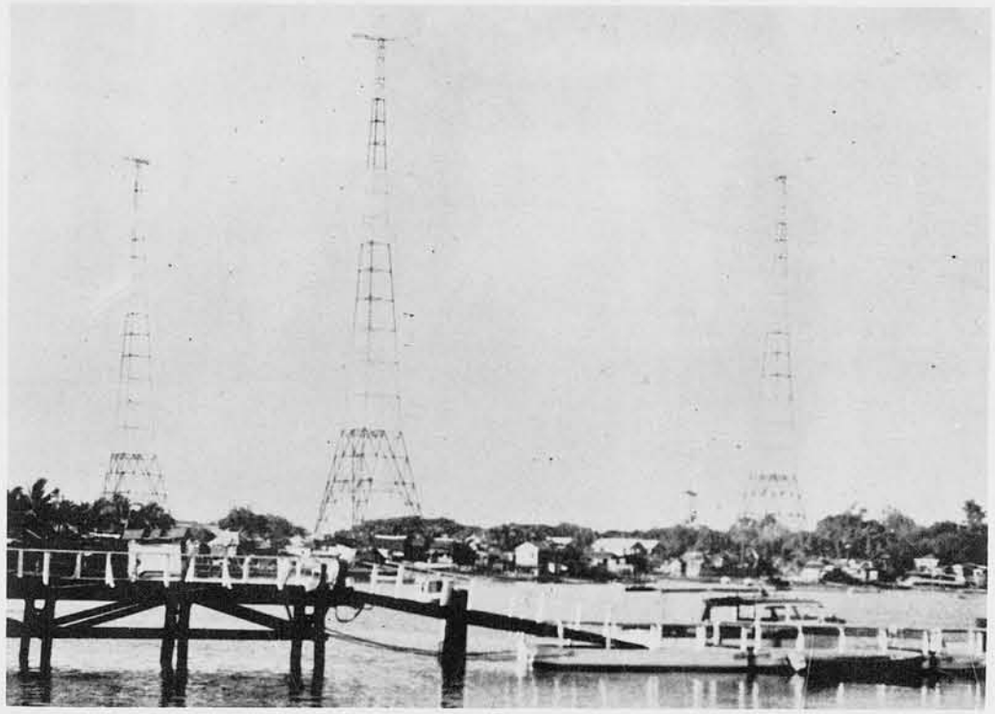
COMMUNICATIONS
SUMMARY

Radio communication plays a very important part in the Japanese military system and has been developed to a great extent, both in quality and quantity. German technical skills are known to have contributed to the former, and for years the Japanese themselves have been building an elaborate communications network throughout their widely dispersed empire.

The problem of interpreting radio communications installations correctly and precisely is more complex than with other electronics equipment, even though the installation may often be catalogued as "radio" at a glance.

Apparently conscious of their "Achilles heel" of communication, the Japanese have followed a policy of duplication of installations, multi-frequency set-ups, camouflage, well protected power plants etc. A typical coral atoll, for example, will contain three or four large stations operating over hundreds of miles, and countless small stations, difficult to spot on aerial photographs.

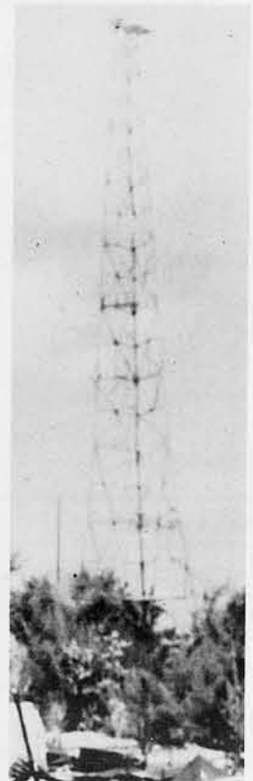
In addition to these are well made semi-portable and portable transmitters and receivers,& hand-held walky-talkies. Also, weather stations, communications auxiliary to D. F. installations, and Radio ships.



PHILIPPINES

This U.S. station in the Philippines is more powerful than is likely to be found in most Japanese controlled areas. At the present time the mast at the far left is missing. However, the enemy is thought to be using the two remaining masts in connection with a station now operated by them. These are called "lattice masts" and are 600' high, with a spread at the base of 125' or more. Masts of Japanese design, found to date, are usually not over 350' in height.

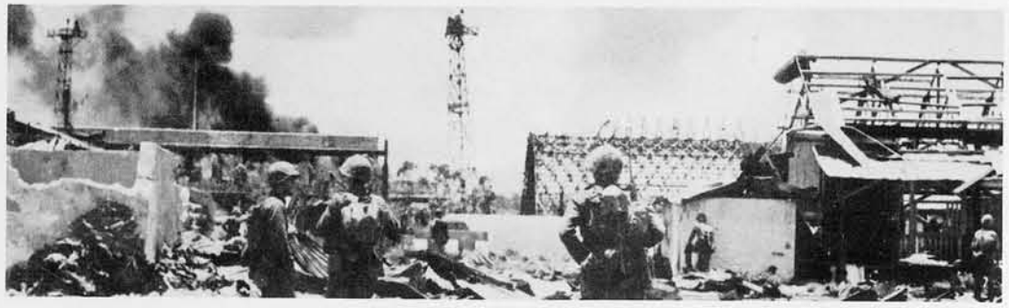
SAIPAN, MARIANAS



SAIPAN

TINIAN, MARIANAS

(R.F. - 1/5000)



TINIAN, MARIANAS

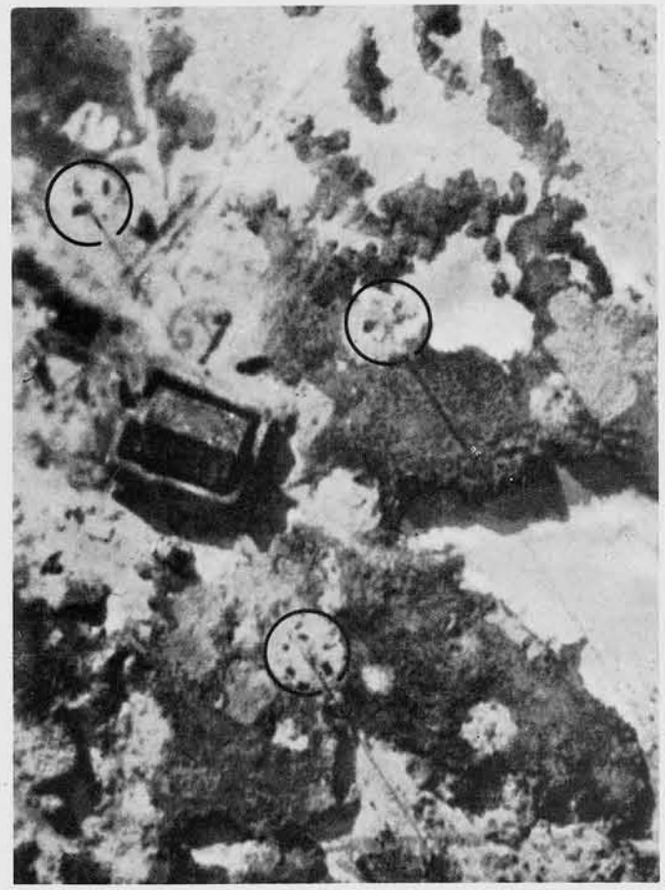
CONFIDENTIAL

COMMUNICATIONS

SUMMARY (CONT.)

In this section an attempt has been made to treat more exactly than heretofore, the interpretation of fixed radio installations, based solely on features that can be seen by the Photographic Interpreter.

In that antennae can seldom be seen on aerial photos, masts are of primary importance in interpreting radio communications. In vertical photos mast location, type and height can often be determined by the shadows they cast on the ground.



(R.F. - 1/2000)

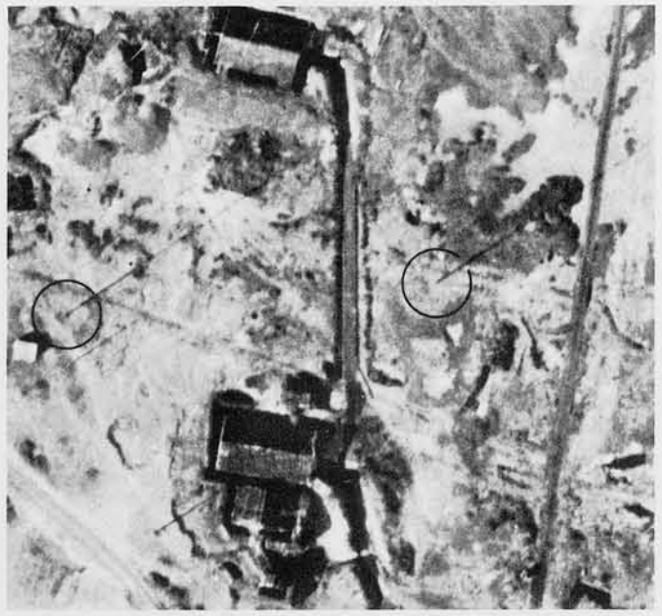
KISKA

ABOVE: In this view of a 3 mast Kiska station, the masts would not be visible were it not for the shadows cast by them.

The masts usually surround, or are close to the transmitting building.

RIGHT: Antennae and lines supporting masts are barely visible here at an elevation of 100 feet. Few pictures afford this amount of detail, however.

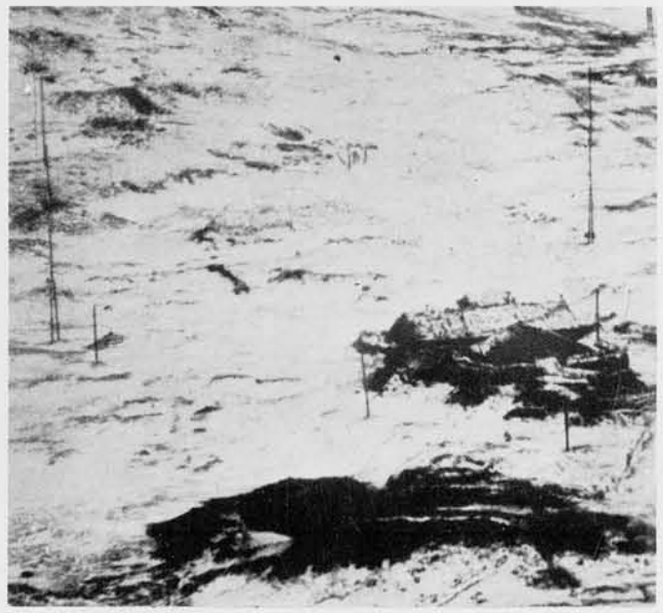
BORAM, NEW GUINEA



(R.F. - 1/2000)

KISKA

ABOVE: This 2 mast Kiska station contains 75' spliced wooden masts and smaller power line poles crossing diagonally at lower left of picture.



KISKA

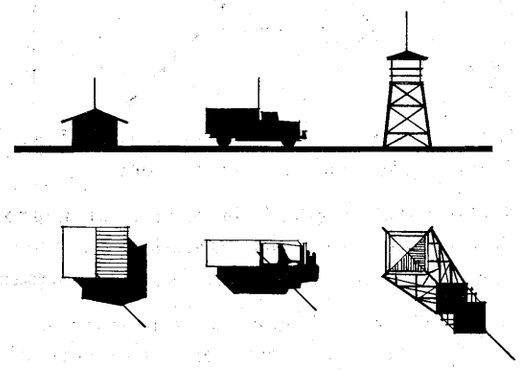
ABOVE: Low oblique of masts and poles. This spliced mast design is usually 75' high and is a favorite of the Japanese.

COMMUNICATIONS
SUMMARY (CONT.)

On this page are shown examples of the various mast designs in use by the Japanese. Shadow patterns are indicated to stress the importance of this method of interpretation.

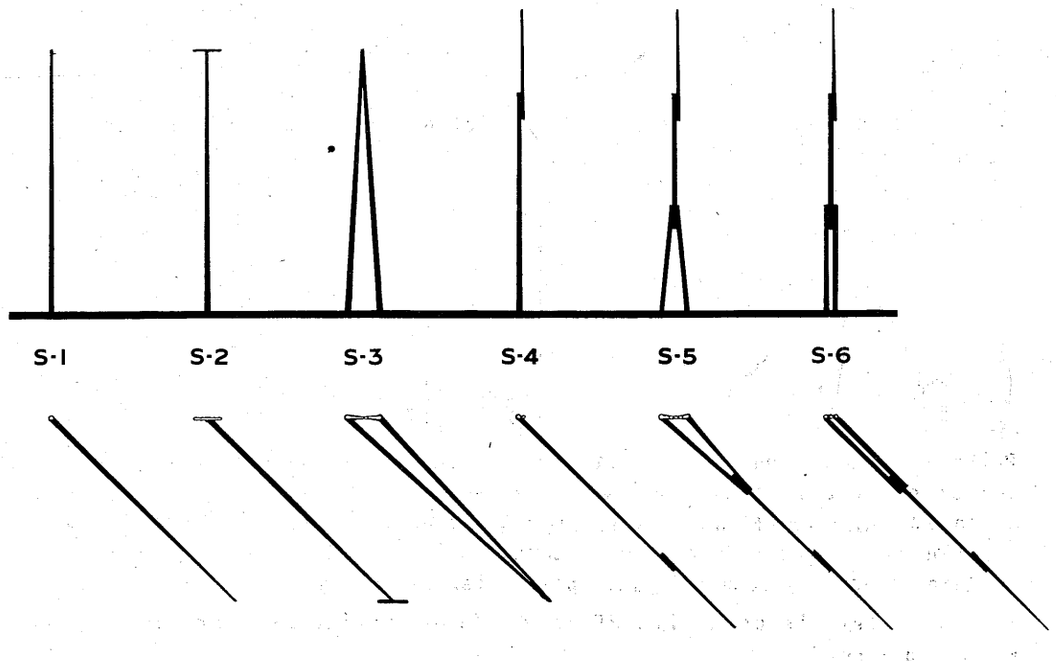
WHIP MASTS

There are many other types and locations in connection with portable, mobile, ship and aircraft equipment, which are usually impossible to interpret adequately in small scale vertical photography.



STICK MASTS

Below are shown six designs of stick masts found in Japanese areas. With the exception of S-1 and S-2 these are generally between 50 feet and 75 feet in height. S-5 and S-6 are usually 75' high. With good photography it is often possible to determine exact design, even at fairly small scale.

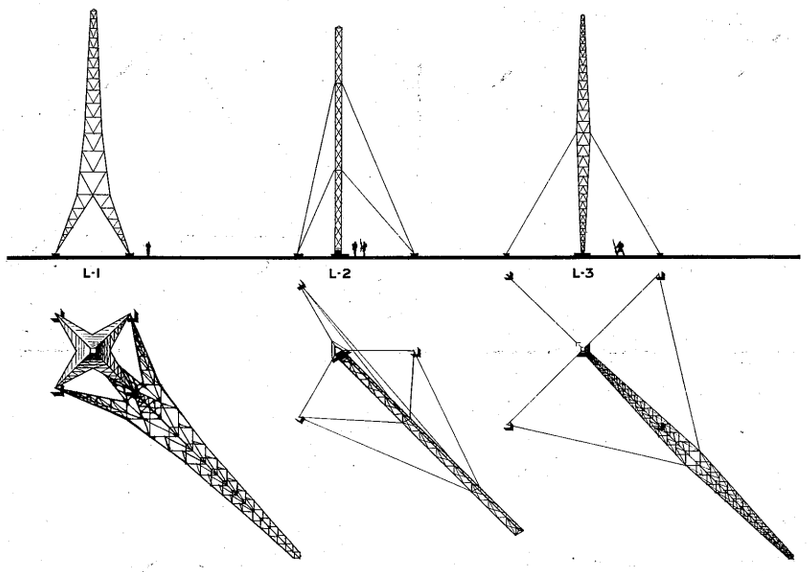


LATTICE MASTS

A great variety of designs occursin lattice type masts. They are usually of steel construction with prefabricated members. The following diagrams show certain basic types which are frequently found with enemy installations.

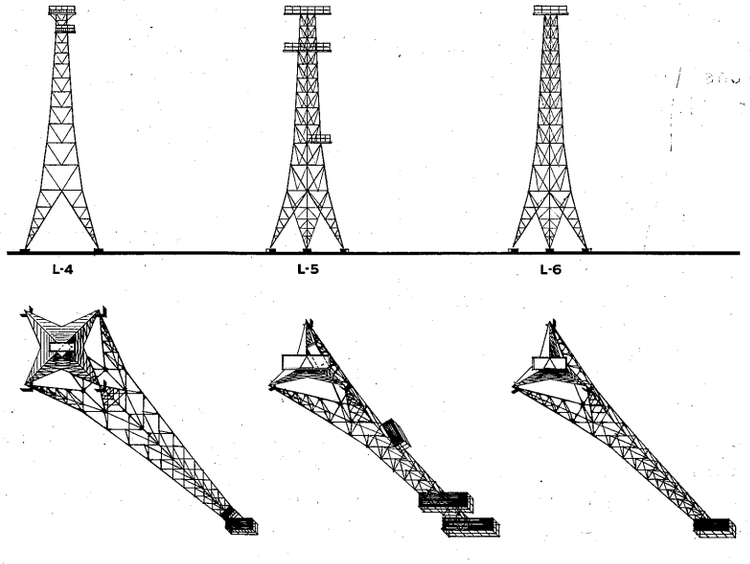
L-1, L-2, and L-3 are more typical of occidental design, and often indicate pre-war broadcast stations.

Lattice masts may range in height from 60 feet to 600 feet with the majority falling between 75 feet and 300 feet.



PLATFORMS

Lattice masts with Japanese military radio stations usually have platforms as indicated below. L-5 is likely to be found in threes and is normally 75 feet high.



COMMUNICATIONS

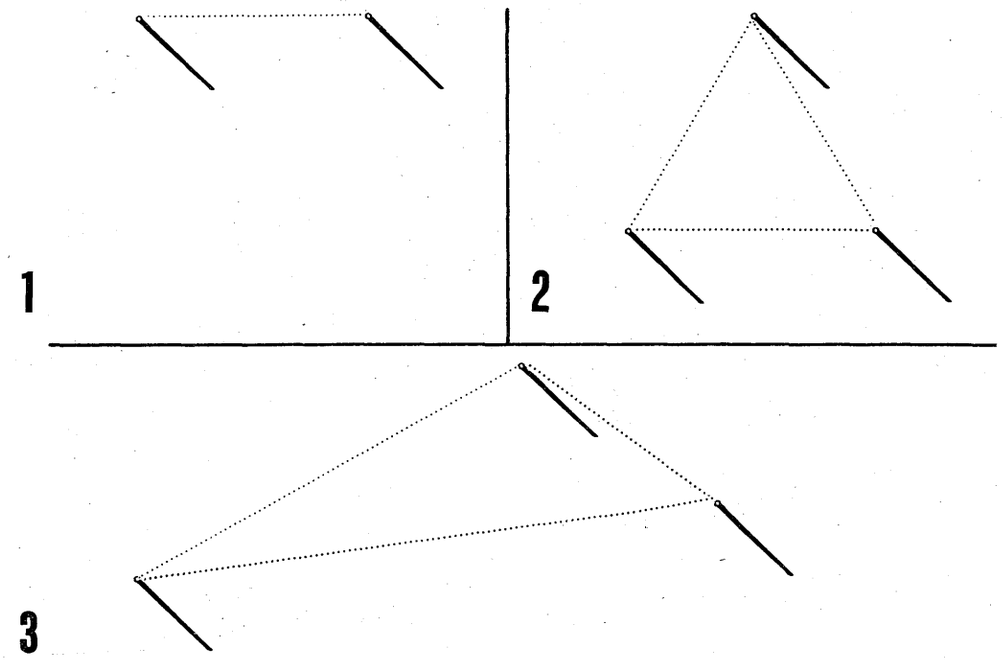
SUMMARY (CONT.)

MAST PATTERNS

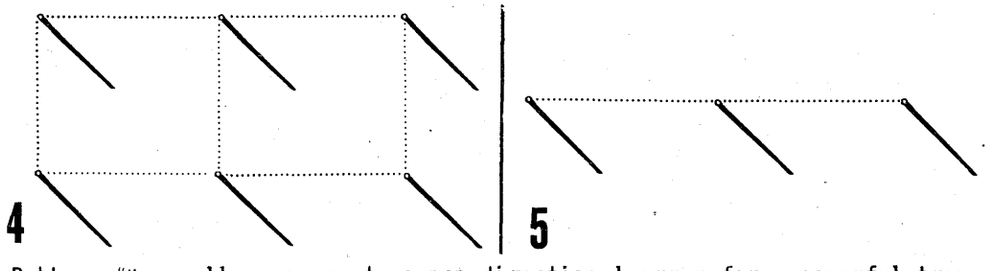
Patterns in vertical photographs are important insofar as they indicate directional capacities and probable use. Certain directional patterns of masts indicate Direction Finding or Navigational Aids, which removes the installation from the category of communications.

A single mast is non-directional.

Note: Dotted lines are to show form of pattern and do not necessarily represent location of antennae. Arrow indicates direction(s) of radio "beam".

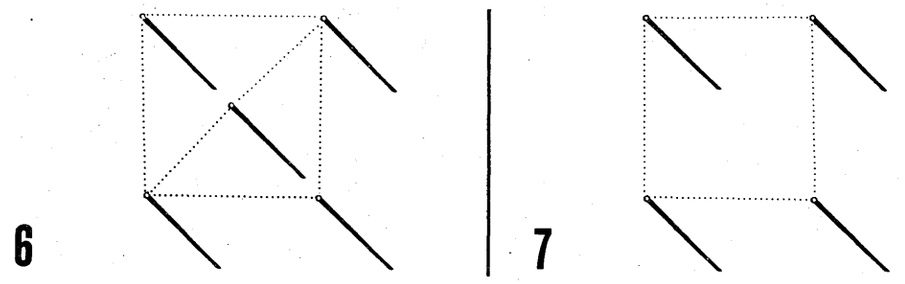


Patterns #1, #2, and #3 represent non-directional Radio Communications. Although it may be possible to achieve directivity from these patterns, particularly #1, they are much more likely to be used for non-directional communications and constitute the most frequently found patterns for communication stations.



Pattern #4 usually represents a non-directional array for a powerful transmitter. However, it can be directional (on long or short axis) if spaced and fed for that purpose.

Pattern #5 can represent directional high frequency transmission, if masts are spaced close together ($\frac{1}{2}$ wave length).



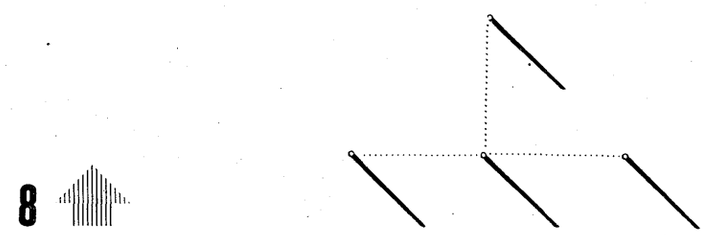
Patterns #6 and #7 are examples of arrangements that are likely to create difficulties in interpretation:

#6, with a diagonal dimension of approximately 600 feet is likely to be a radio range station capable of sending a navigational beam in any prescribed direction. This is not a communications pattern.

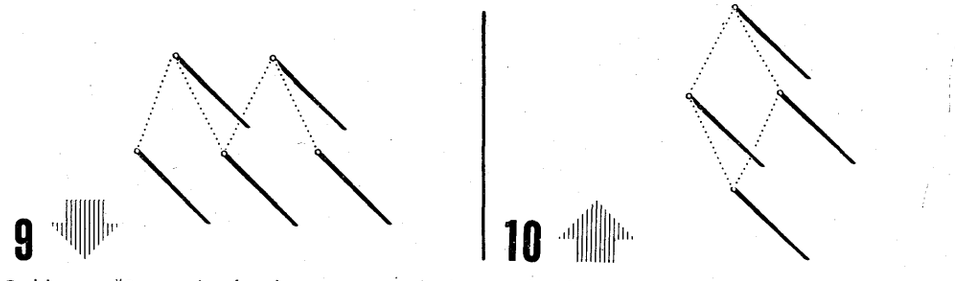
#7 is either a communication station pattern or a direction finder pattern.

(a) If Communications, the size will be a clue. The diagonal dimension will then be from several hundred to two thousand feet. Large auxiliary buildings, housing transmitter, power house, offices and personnel quarters will be visible.

(b) If a Direction Finder, the diagonal dimension will be approximately 100 feet. In Japanese design there is likely to be a small shack in the exact center of the pattern, but this is not absolutely necessary. Diagonal underground cables are usually visible.



Pattern #8 represents a communications station which may be directional as shown by arrow.



Pattern #9 used singly or repeated may indicate a navigational aid, either for ships or aircraft. Such an arrangement is also used for intercept purposes; for directional communication, 2 masts may be at point of "V".

Pattern #10 indicates directional communications and is called a "rhombic" pattern. It usually occurs in multiple units, radiating from a central point.

Such a pattern is used with HF or VHF transmitting gear or may support receiving antenna.

MAST HEIGHTS

Heights of masts are the best indication of the frequency and range of the radio installation. This is true because it is desirable to raise the antennae, and, thus, the feed wire which transmits, as far off the ground as possible for best operation. By relating the height to the number and type of mast, it is possible to estimate the station capacity by fairly logical means.

IN GENERAL

High Mast = low frequency = long wave = long range
Low Mast = high frequency = short wave = short range

The following table will be helpful in estimating frequencies and ranges from masts visible on aerial photographs.

JAPANESE RADIO COMMUNICATIONS, MAST-FREQUENCY RELATIONSHIP
FIXED INSTALLATIONS

	FREQUENCY	NO. MASTS	MAST HEIGHT	FREQUENCY IN MEGACYLES PER SEC.	WAVE LENGTH	*** USUAL OPERATING RANGE
STICK MASTS	*VERY HIGH (LINE OF SIGHT)	1	GERMAN DECIMETRE STATIONS HAVE 160' MASTS	30 TO 300 MCS (50 TO 100 LIKELY)	10 TO 1 METER	75 MILES
	HIGH	1 TO 3	WHIP ANTENNAE OR VERY SMALL STICK MASTS	3 TO 30 MCS	100 TO 10 METERS	****200 MILES
	MEDIUM**	2 OR MORE	50' TO 75'	0.3 TO 3 MCS	1000 TO 100 METERS	500 MILES
LATTICE MASTS	MEDIUM**	2 OR MORE	60' TO 100'	0.3 TO 3 MCS (300 TO 3000 KCS.)	1000 TO 100 METERS	500 MILES
	LOW	2 OR MORE	100' TO 500' (125' TO 300' MOST LIKELY)	0.03 TO 0.3 MCS (30 TO 300 KCS)	10,000 TO 1000 METERS	1000 MILES
	VERY LOW	3 OR MORE	400' TO 800' STICK OR LATTICE	10 TO 30 KCS	30,000 TO 10,000 METERS	5000 MILES

* Although there are many types of V.H.F. antennae in connection with portable, mobile, and airborne equipment, no fixed Japanese installations have been seen as yet which operate at such high frequency.

** Most used for land based communication stations.

*** Very rough figures, dependent on many factors.

****When utilizing sky waves, H.F. can transmit over long distances (beyond 1000 miles) on any height of mast.

Estimates of frequency in the following pages are based on the lowest frequency, and auxiliary higher frequency transmitters should be presumed to be present.

Rule of thumb method to determine wave length: Approximate wave length (in meters) 4 x mast height (in meters).

RANGE

1. Some factors which affect range are transmitter power, time of day, weather, time of year, sun spots, and receiver sensitivity.
2. A single steel lattice mast may sometimes be used as a radiating mast and its range would be less than normally expected of its height because of electrical difficulties in transmitting in this manner. In this case the station must operate on a limited fixed frequency and cannot be directional.
3. Many masts imply many channels of communication and do not necessarily mean added range.
4. Siting of masts on or near water gives added range.

SPACING

Spacing between masts in communications is not very important electrically, as is the case in Direction Finding and Navigational Beam installations.

However, due to the mechanical difficulties of supporting antennae in long spans, it can be assumed that the longer the span (or distance between masts) the more powerful the transmitter, for it would not be economically wise to build equipment in excess of the needs of the power of the transmitter.

By this reasoning, for example, a spacing of 500-600 feet would imply that a low frequency transmitter of considerable power were present.

[redacted]

COMMUNICATIONS

SUMMARY (CONT.)

BASES

Bases of lattice masts consist of three or four legs, set in square blocks of concrete which often show up clearly in aerial photos. (Occasionally the concrete bases of stick masts are visible)

It is quite possible to determine, very roughly, the height of the lattice mast by the distance between legs at the base. (this table for Japanese masts only).

Distance between legs.			Height of Mast.		
10	-	20	60'	to	75'
20	-	30	75'	to	125'
30	-	45	125'	to	200'
45	-	65	200'	to	300'

However, it is recommended that shadow or parallax measurements be used to determine height wherever possible.

PLATFORMS

Most Japanese lattice masts of recent design incorporate a relatively elaborate system of platforms near the top, triangular and rectangular in shape, ranging in size from 25 square feet to 125 square feet in floor area.

These platforms occur singly and in twos and threes. In a three mast station, identical platforms are found in each of the three masts.

NAMUR

PALAU

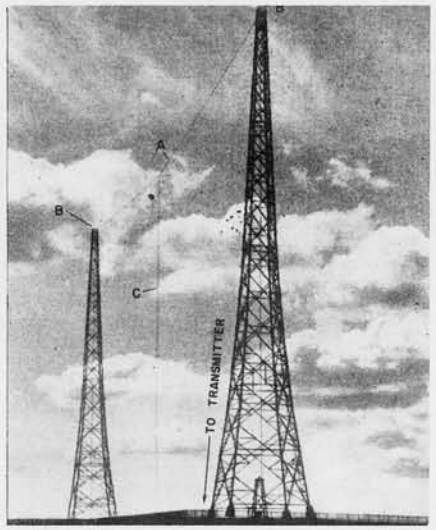
PROBABLE USES

a. Observation. In many cases no other observation towers are present.
b. Warning devices. Note siren in photo. (left above)
c. Light Beacons.
d. Visual Signals - The Japanese now possess, in addition to the usual blinker light signaling systems, equipment of German design which can send blinker or voice and may use infra-red light. The range is approximately eight miles and is not vulnerable to the usual jamming methods.
e. Antennae. It is possible but not determined by ground information, that certain platforms on low and medium frequency masts may contain high or very high frequency whip antennae or dipoles.

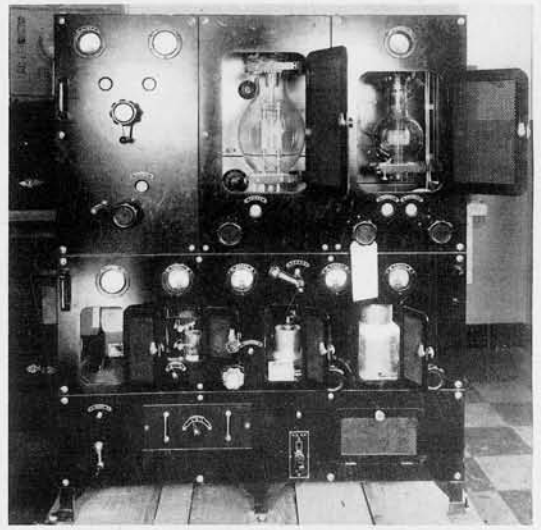
TRANSMITTERS

1. The transmitter is the most vital installation in a communications set-up and is usually found within 300 feet of the masts. It is possible that the communications office may be separated from the transmitter but the latter will be near the masts nevertheless. Generally they are grouped together, however. (See "Communications Centers").
2. Range increases as the square root of the increase in transmitter power. Example: 4 times the power = 2 times the range.

With this in mind, it can be readily seen that tremendous additional power must be used to establish reliable communications beyond the range for which the station was designed.



"A" - Antenna, "B" - Insulators, "C" - Feed



MEDIUM FREQUENCY TRANSMITTER

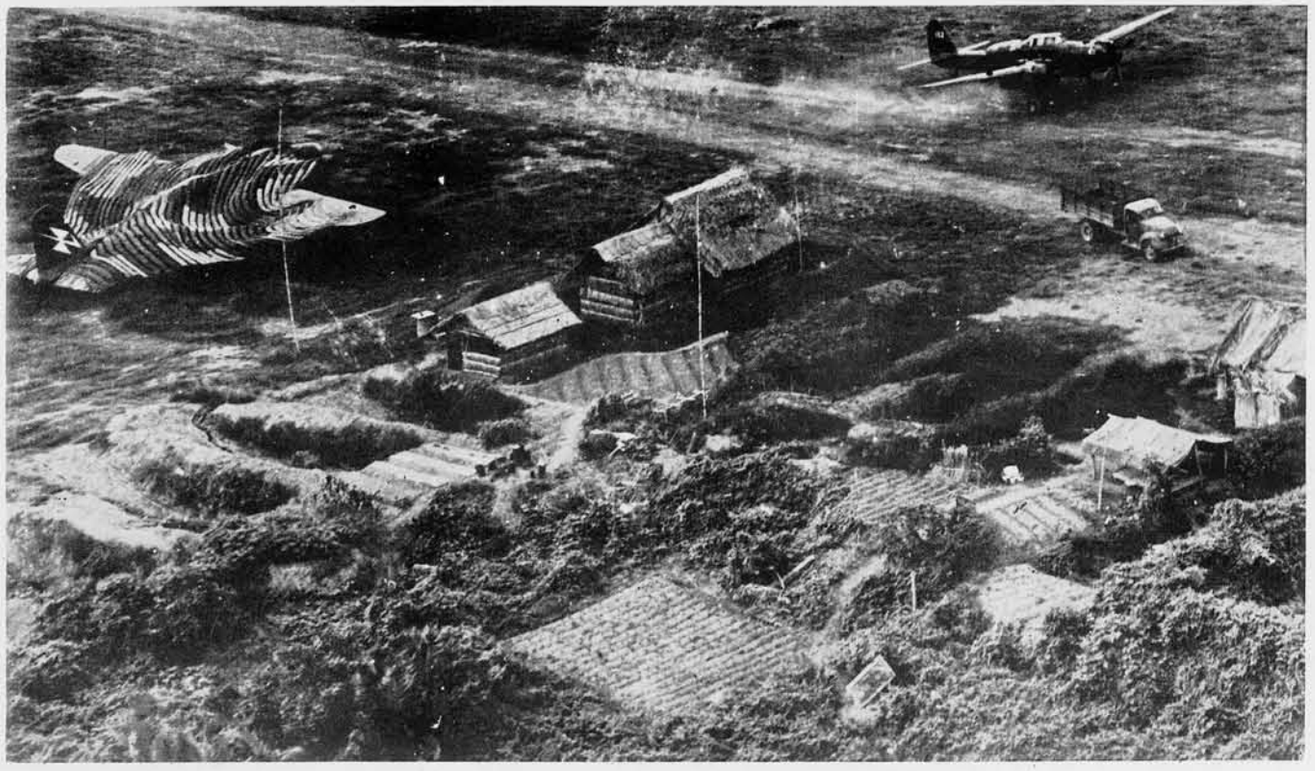
Receiving stations are often found some distance away from transmitting stations, and have their own masts and antennae.

PHOTOGRAPHIC INTERPRETATION REPORTS

In writing reports on Radio communication installations, it is desirable to mention the following:

1. Probable frequency of station.
2. Probable use of station.
   Example: (a) Communication Center
   (b) Weather Station etc.
3. Probable geographic area of range.
   (a) Important geographic connecting points (for medium frequency stations, particularly).
   (b) Other known stations within range.
   (c) Directional capabilities, if any.
4. Pattern of masts, especially if installation suggests a possible Direction Finder or Navigational Aid.
5. Location of transmitter and generator buildings.

COMMUNICATIONS
HIGH FREQUENCY



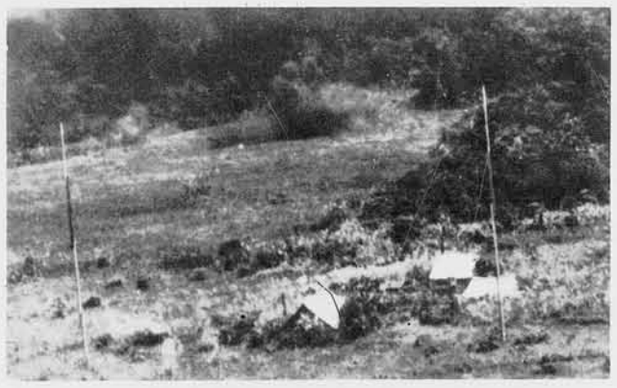
3 MAST-HIGH FREQUENCY

ABOVE: Ground to plane communication. Japanese High Frequency aircraft band is approximately 5 to 10 Mcs. High Frequency Radio Communication is not used by the Japanese for large land based stations except as a supplementary transmission. It is used as follows, (except for long range sky wave of approx. 10 mcs.)

(a) Near airports for communication with pilots in the air or on the runway
(b) Small well-hidden stations for short distance communications between commands
(c) Semi-portable, portable, mobile, and walky-talky sets for the ground troops, A/A batteries etc.

All of these types are extremely difficult to pick up on aerial photographs.

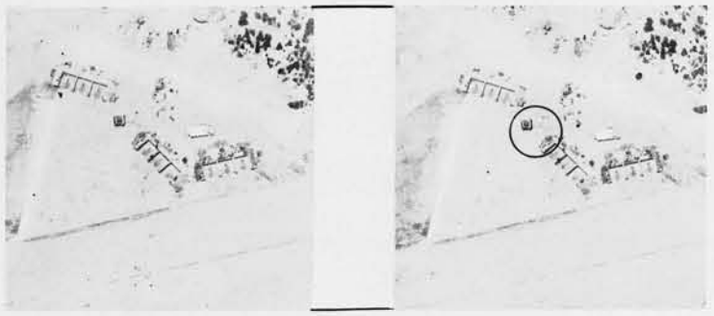
Mast arrangement may assume a variety of forms but is likely to be made up of small, flimsy wooden stick masts or whip antennae.



2 MAST-HIGH FREQUENCY

LEFT: Probable High Frequency Field Radio Station with transmitter and receiver housed in tents. This type of station may be interpreted with good photography at scales of 1/10000 or less.

Insufficient information is available on the use of Very High Frequency (V.H.F.) fixed installations by the Japanese. No transmitters of this frequency have been captured. V.H.F. can be used for portable transmitters, aircraft communications, and point to point communications over short distances (up to 75 miles). The German "Decimeter Stations" (which are 30 miles apart) are an example of the latter use.

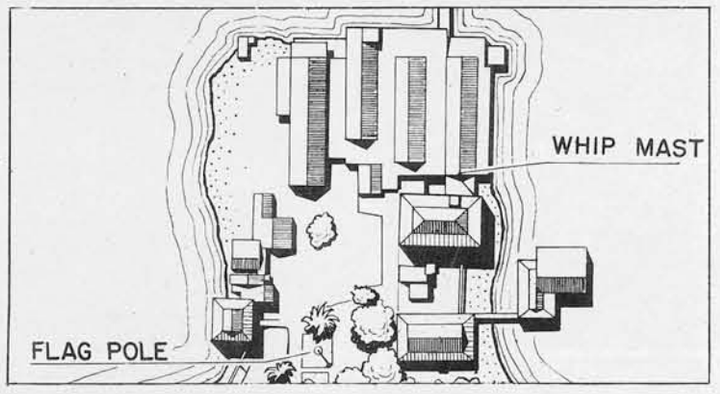


SINGLE MAST-HIGH FREQUENCY (R.F. - 1/7500)

ABOVE: Another example of ground to aircraft communication. This may be a type of stick mast or whip antennae carrying High Frequency messages for use of control tower at airport. Radio operates at 3-30 Mcs. This mast may be called a "whip antennae".

(R.F. - 1/2500)

WHIP ANTENNAE - HIGH FREQUENCY



ABOVE: Stereogram and sketch of whip antennae mounted on top of warehouse building. Such a station is often impossible to spot in aerial photographs, except when coverage is unusually low and photos are good. High Frequency transmitters are normally used for Communications over distances of less than 200 miles.

COMMUNICATIONS

MEDIUM FREQUENCY

Most Japanese communication stations fall in the Medium Frequency band (0.3 to 3 Mcs.). These stations take on many forms. The typical military communications center with a somewhat standardized concrete building and three 75 feet high lattice masts is already familiar to interpreters. Examples of these are shown under "Communication Centers".

In addition, a less standardized use of spliced stick masts with associated buildings of various designs and adaptations, is widely employed for medium frequency antennae in advanced areas.

Some stations, classified as "Medium Frequency" on these pages, probably overlap into the "Low Frequency" band. International standard breakdown and nomenclature is used for classifications throughout this report.

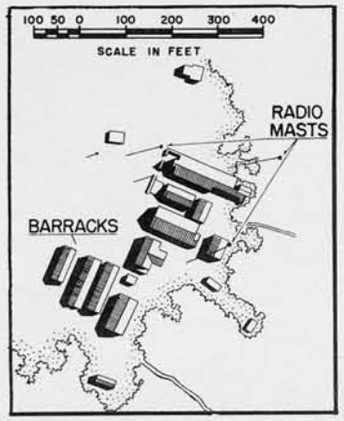
In the more built up land areas captured by the Japanese and on Japan itself will be found many peacetime broadcast stations operating in the medium frequency band as well as stations associated with airfields and industry. All of this latter group are likely to employ lattice masts.

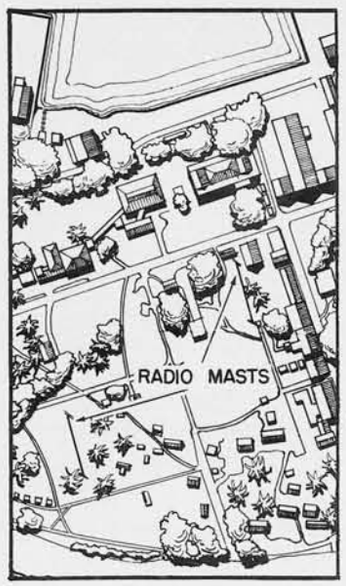
In this section, many examples of various types are shown and salient information and dimensions, as may be obtained from aerial photographs, are presented. Ground information is not yet available on most of the installations shown, so it is best not to regard any specific interpretation as the final word, but, rather, to utilize the benefits of a reference collection and an interpretation approach.

On this page are shown two Medium Frequency Communications Stations utilizing stick masts.

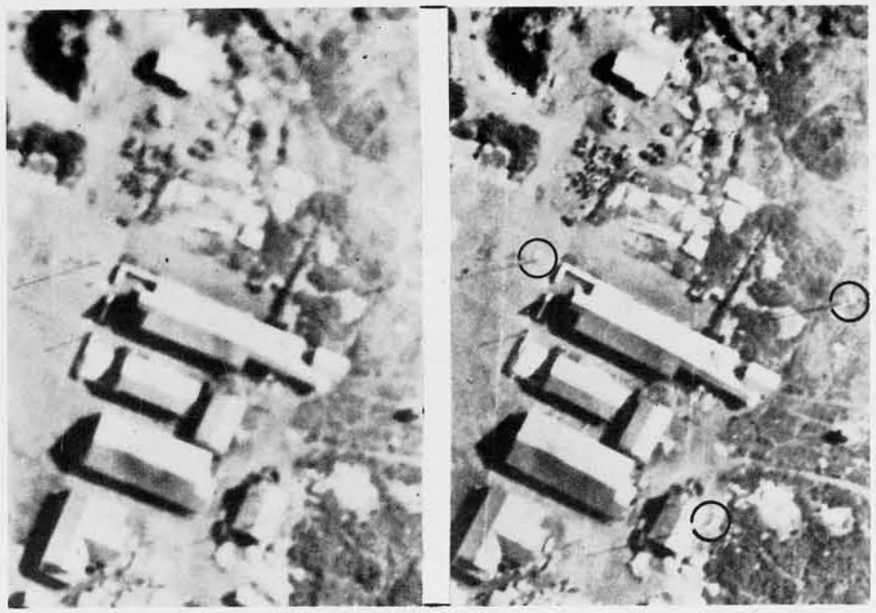
JALUIT: Masts over 100 feet high and 425 feet apart are excessive for Medium Frequency. However, it is unlikely that Low Frequency antennae would be carried on this type of stick mast. It is quite possible that this station will include the upper part of the Low Frequency band, as well as lower part of the Medium Frequency.

ARAIDO: Three Medium Frequency stick masts, 60 feet high, arranged in a near isoceles triangle pattern.

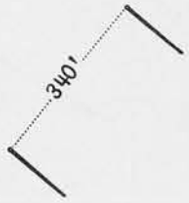




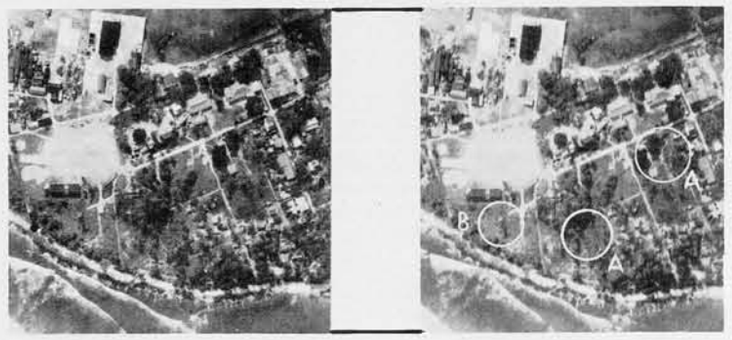
JALUIT, MARSHALLS (R.F. - 1/42500)



ARAIDO, KURILES (R.F. - 1/2000)



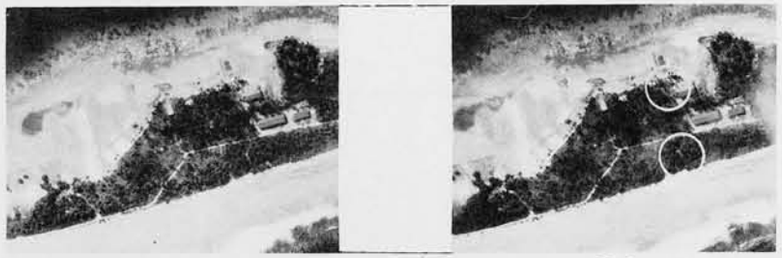
RIGHT:
"A" - 100' stick masts.
"B" - observation tower.



JALUIT, MARSHALLS (R.F. - 1/6750)

CONFIDENTIAL

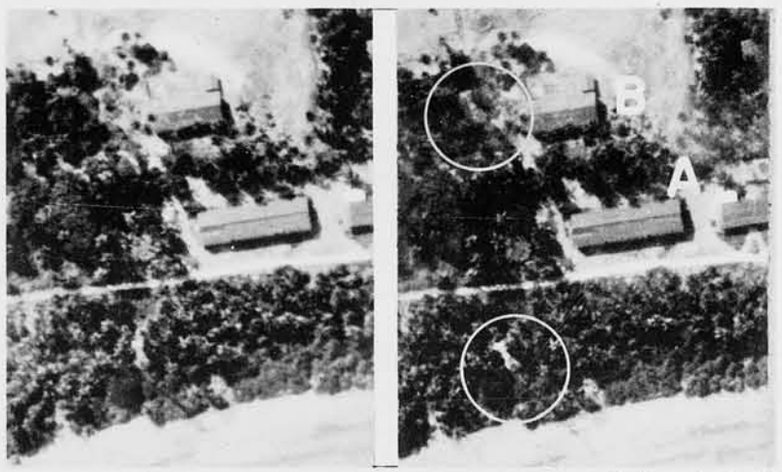
COMMUNICATIONS
MEDIUM FREQUENCY (CONT.)



(R.F. - 1/12000)

JALUIT, MARSHALLS

Medium Frequency Station at Jaluit has two lattice towers, approximately 75 feet high, spaced 350 feet apart.

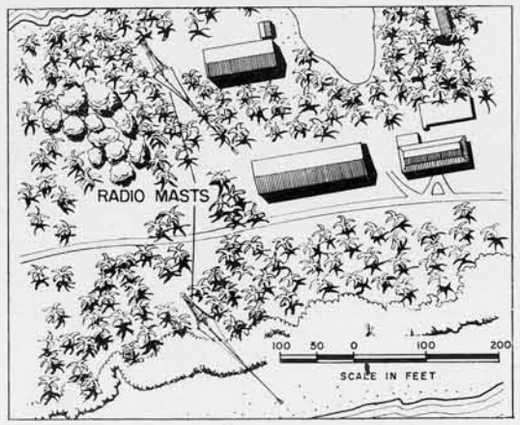


(R.F. - 1/3200)

JALUIT, MARSHALLS

Three masts, of steel lattice design with platform, are L-6 type.

The transmitter is probably at "A"; the power is probably at "B".



350'

JALUIT, MARSHALLS

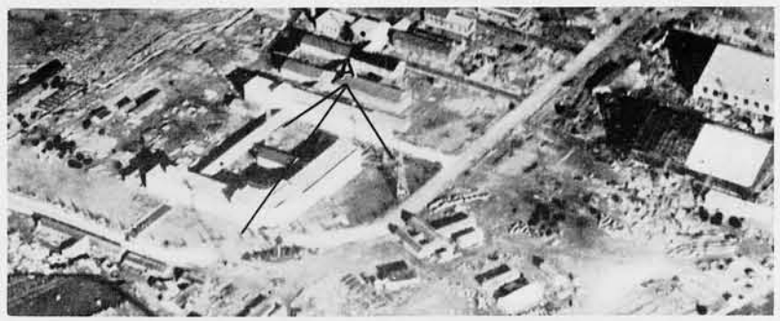
210'

(R.F. - 1/4000)

PALAU

Steel lattice masts at Palau, approximately 75 feet high, are for Medium Frequency Communications. Water siting offers better ground. Type L-6.

375' ±



HOKKAIDO, JAPAN (BIHORO)

300'

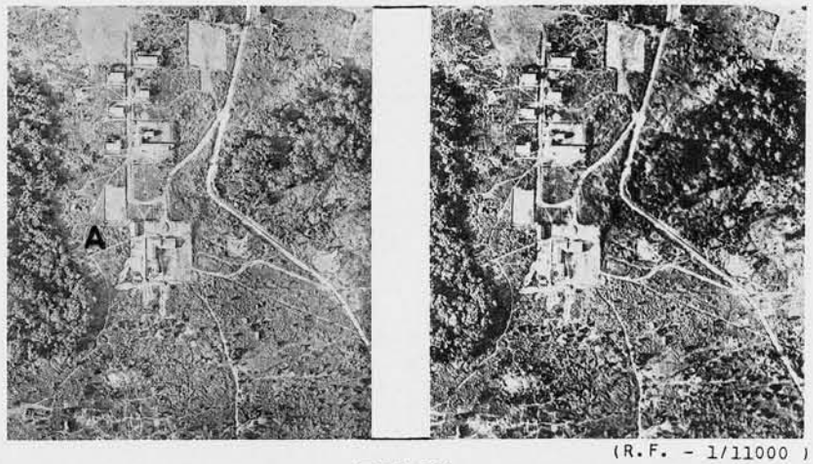
HOKKAIDO, JAPAN (CHITOSE)

The two examples above (Bihoro and Chitose) show Medium Frequency lattice masts in connection with Japanese industrial plants and airfields. Masts are type L-6.

Lattice masts (A) are 100 feet or less in height, which indicates probable Medium Frequency - but fairly powerful stations.

CONFIDENTIAL

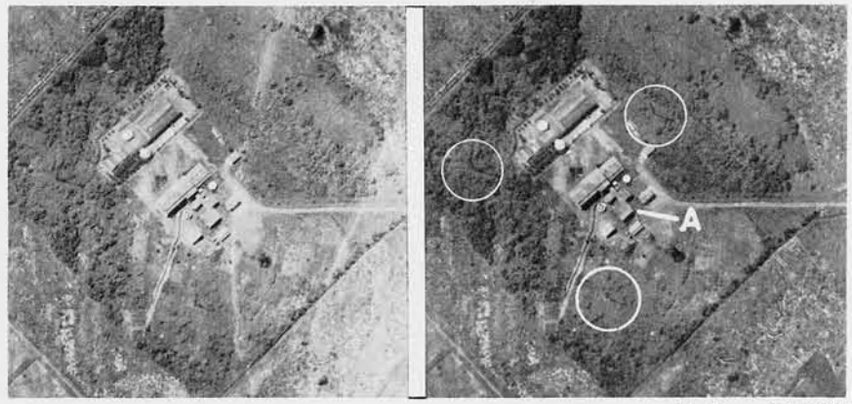
COMMUNICATIONS
MEDIUM FREQUENCY (CONT.)



(R.F. - 1/11000)

PALAU

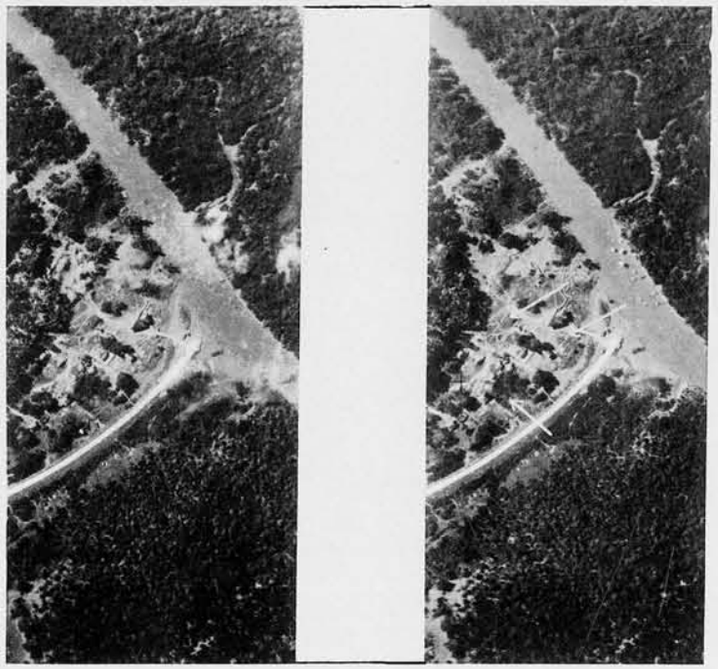
Probable Medium Frequency lattice masts, type L-6. This arrangement is unusual in that the towers do not appear to be related to a transmitter building for convenient direct feed wire connection. Note power or telephone line at "A". This is a border-line example and could be Low Frequency or a powerful Medium Frequency Station.



(R.F. - 1/4500)

PONAPE, CAROLINES

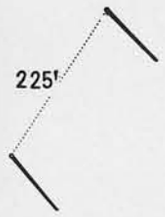
Medium Frequency station with three type S-5 stick masts. Transmitting building is at center of three masts. Power is at"A" (Note proximity of water cooling building). Building at top is a barracks. A station of this size frequently has lattice masts.

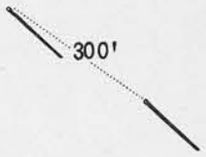


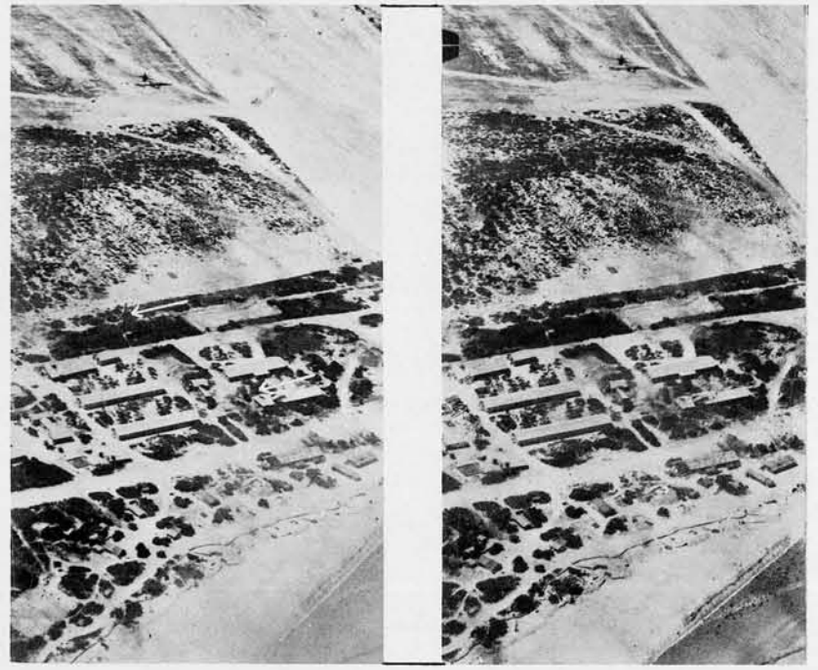
(R.F. - 1/5500)

BURMA

Existing trees might be used effectively to camouflage a radio installation. In this example palms appear to be used as masts for support of Medium Frequency antennae.



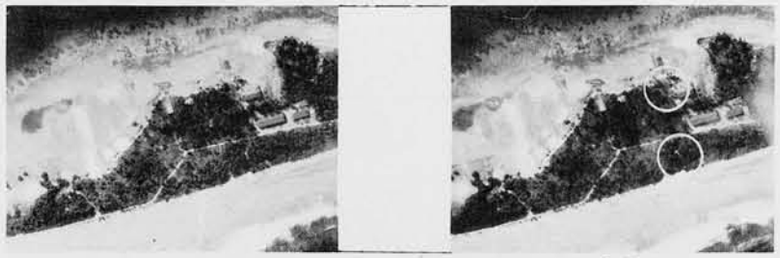




WAKE

Stereo-oblique of Medium Frequency station with 60' type S-1 stick masts. Transmitter appears to be buried.

COMMUNICATIONS
MEDIUM FREQUENCY (CONT.)



(R.F. - 1/12000)

JALUIT, MARSHALLS

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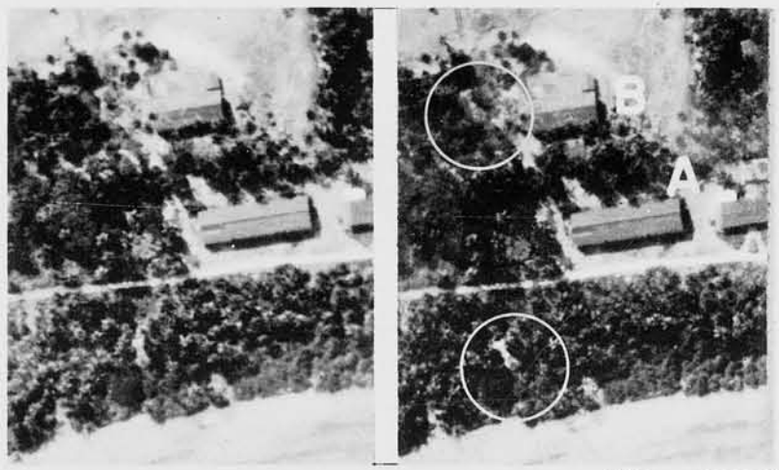
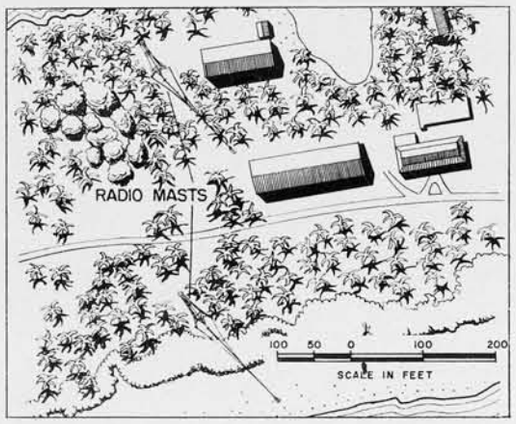


(R.F. - 1/3200)

JALUIT, MARSHALLS

Three masts, of steel lattice design with platform, are L-6 type.

The transmitter is probably at "A"; the power is probably at "B".



350'

JALUIT, MARSHALLS

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(R.F. - 1/4000)

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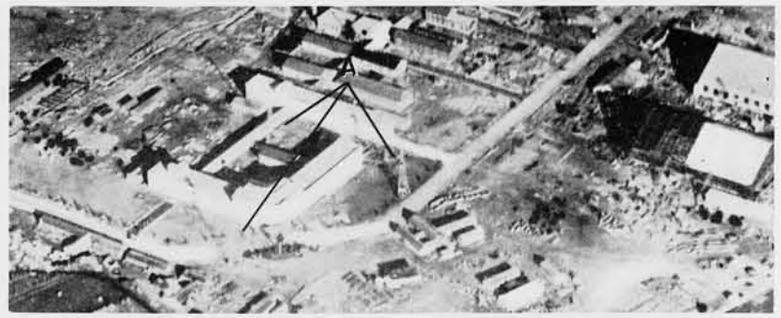

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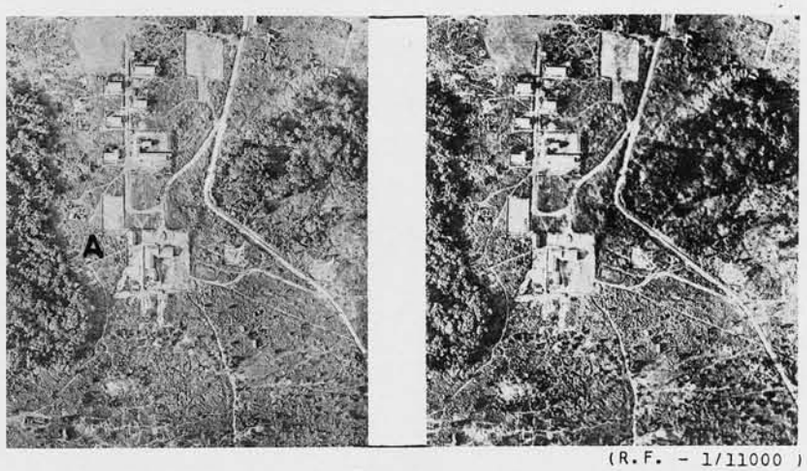
CONFIDENTIAL

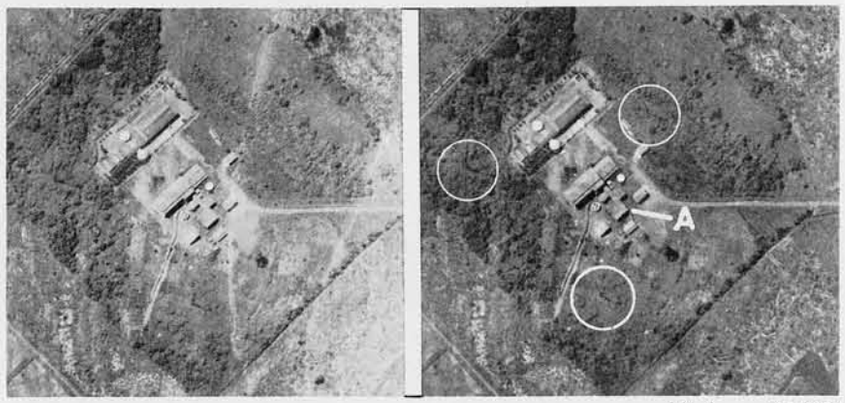
COMMUNICATIONS
MEDIUM FREQUENCY (CONT.)



(R.F. - 1/11000)

PALAU

Probable Medium Frequency lattice masts, type L-6. This arrangement is unusual in that the towers do not appear to be related to a transmitter building for convenient direct feed wire connection. Note power or telephone line at "A". This is a border-line example and could be Low Frequency or a powerful Medium Frequency Station.



(R.F. - 1/4500)

PONAPE, CAROLINES

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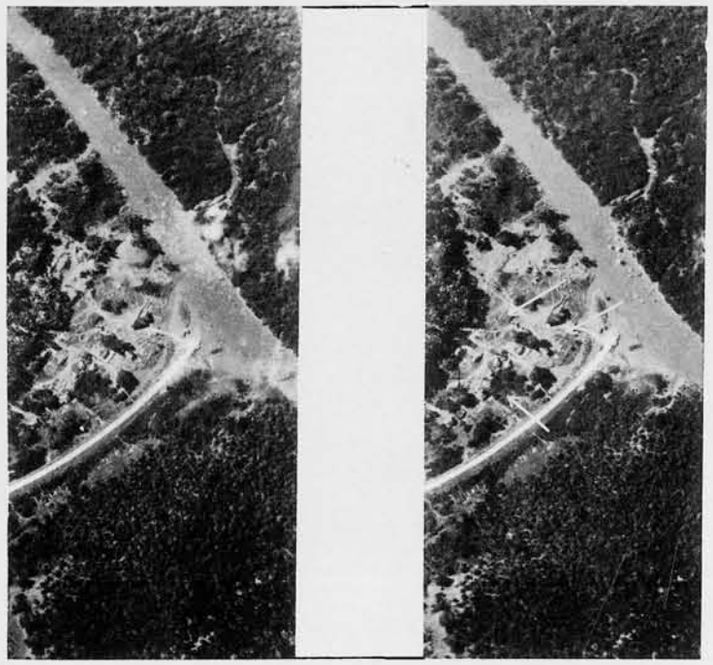

(R.F. - 1/5500)

BURMA

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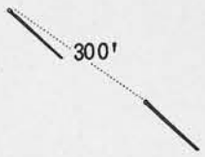

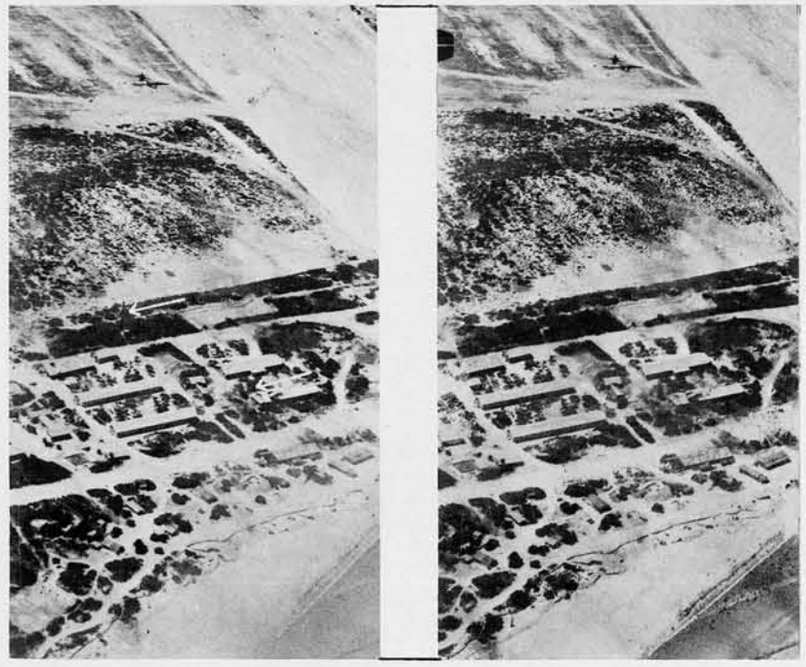

WAKE

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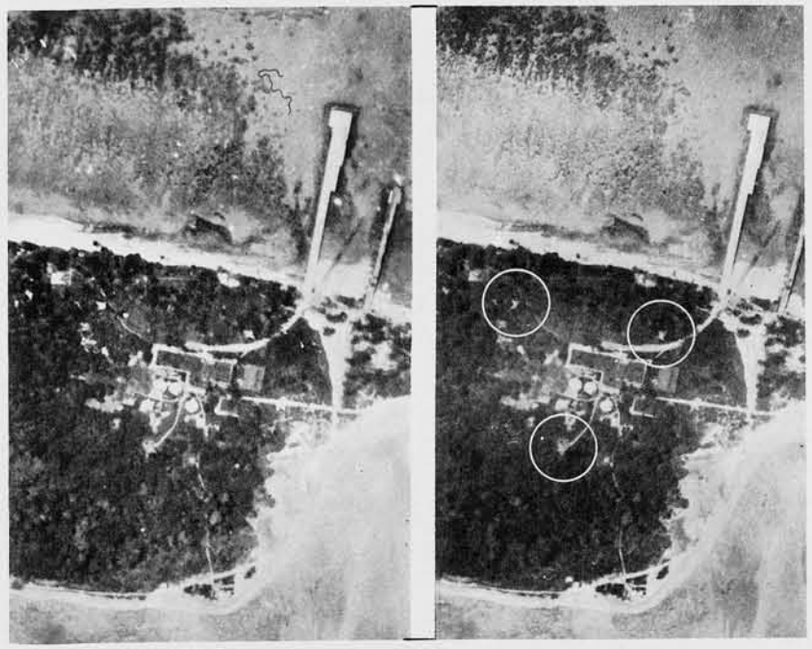
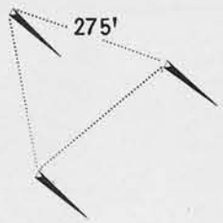


(R.F. - 1/4300)

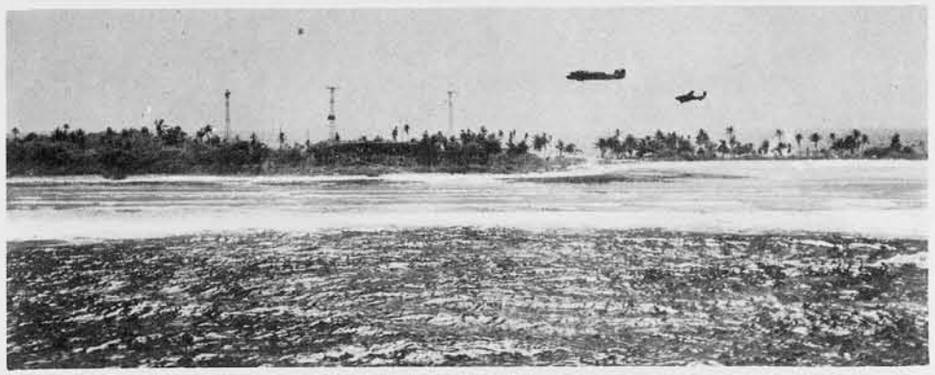
PIGEEYATTO, MALOELAP, MARSHALLS

"A" - Two of the three 75' high lattice masts.

"B" - Platform and signal light.

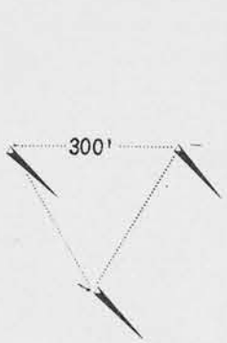


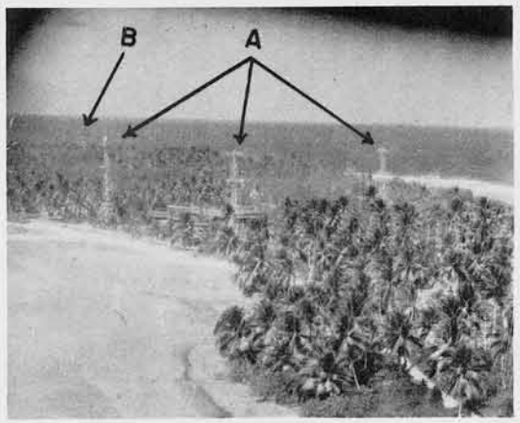
PIGEEYATTO, MALOELAP, MARSHALLS



PIGEEYATTO, MALOELAP, MARSHALLS

ABOVE: The station on Maloelap is introduced here as a typical example of the standard Medium Frequency communications building and arrangements of mast as shown in "Communications Center" section. This design is a favorite of the Japanese throughout their island bases. The lattice masts are usually 75 feet high arranged in an equilateral triangular pattern with 150 to 300 feet sides.

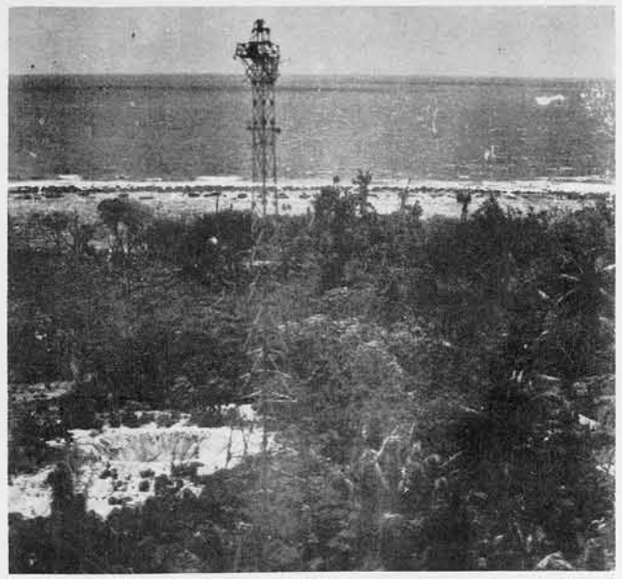




JALUIT, MARSHALLS

Medium Frequency communications center at Jaluit, which is similar to Maloelap.
"A"-THREE LATTICE MASTS - 75 FEET HIGH; "B"-OBSERVATION TOWER.

PIGEEYATTO, MALOELAP, MARSHALLS



PIGEEYATTO, MALOELAP, MARSHALLS

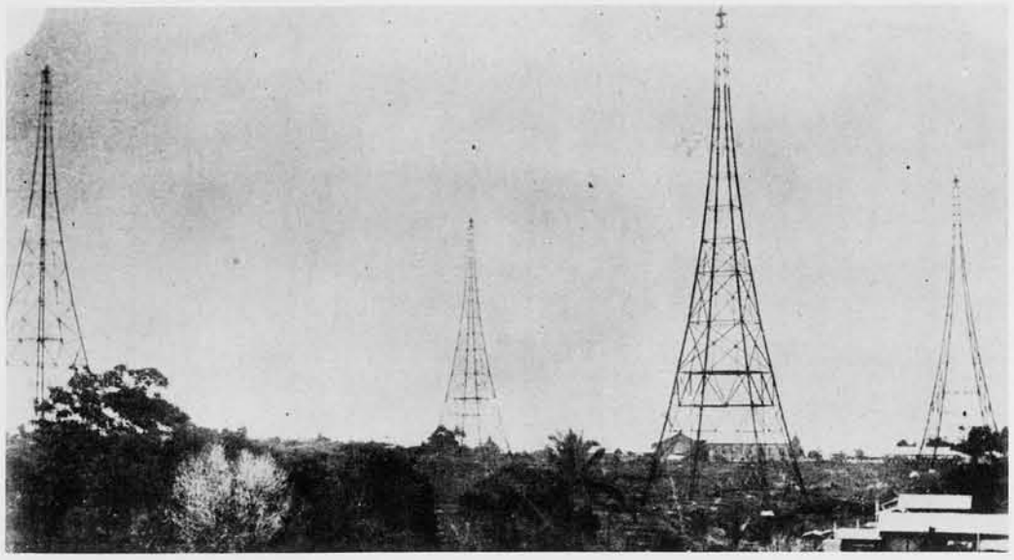
COMMUNICATIONS

LOW FREQUENCY

The stations shown here under "Low Frequency" include "Very Low Frequency" and some that may be unusually powerful "Medium Frequency" stations, which would have added range.

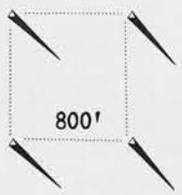
Irrespective of exact determination of frequency, which is often very difficult, it is important to refer to installations such as shown on these particular pages as powerful, long range stations in the lower frequency band.

The most powerful Communications Stations are likely to be Low Frequency and are more often found in the Inner Empire, and in other well-populated conquered areas.



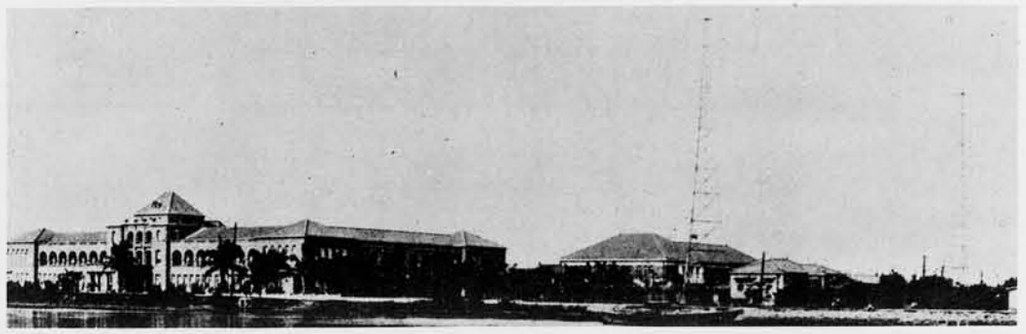
KOROR, PALAU

View of Koror Radio Station taken in 1926. At this time the station operated on several frequencies, including low, and could communicate with Japan. The masts are 300 feet high and arranged in a square pattern, 800 feet on a side.



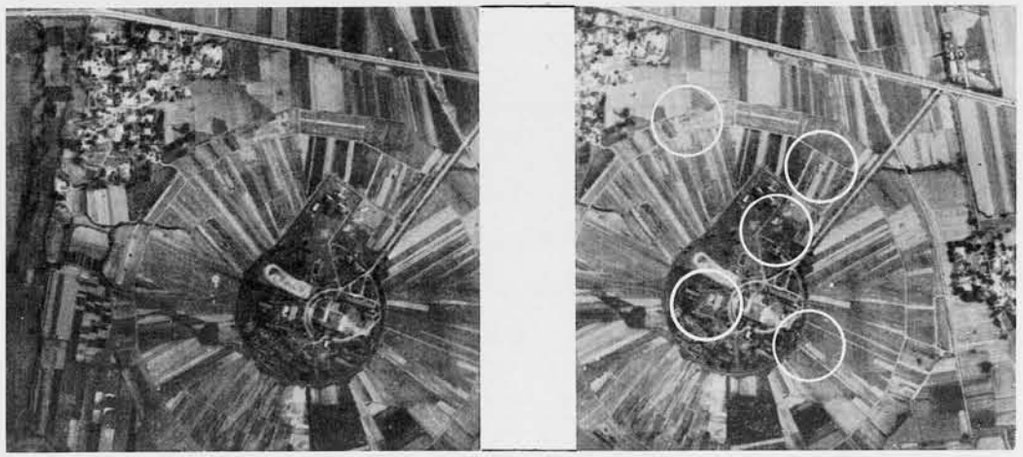
KOROR, PALAU

Same station at Koror taken July 1944. This installation is also included under Navigational Aids because its pattern and dimensions indicate such a capacity in addition to communications.



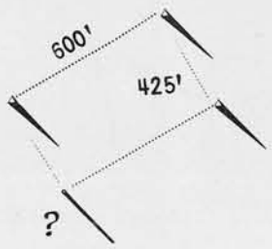
TAKAO, FORMOSA

Low Frequency lattice masts adjacent to Provincial Office Bldg., Takao, Formosa.



TAKAO, FORMOSA (R.F. - 1/16400)

The Hozan Station at Takao is one of the largest and most powerful in Japanese possession. The five lattice masts are 350 feet or more in height. The cross-shaped building appears to be a recently constructed transmitting and administration center. The heavily revetted building probably houses the main transmitter, which may include Low Frequency. Masts are spaced 800' - 1000' The circular and radial patterns seem to be a result of tuning houses which are set up on the outside diameter. These houses are 15 feet square and are arranged in groups of threes (in equilateral triangles); they number 54 in all.



TAKAO, FORMOSA (R.F. - 1/16400)

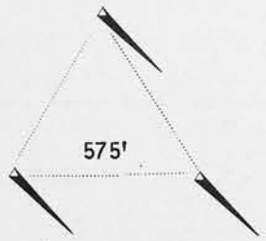
Another probable Low Frequency Station at Takao. Two lattice masts are 125 feet high; two are 90 feet high. Transmitter is in large central building.

Takao has several high powered Radio Communication Stations.

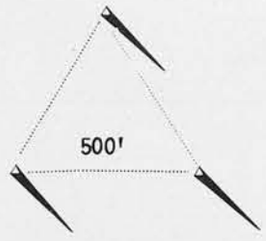
BANKOK, THAILAND (R.F. - 1/17700)

Low Frequency station at Bankok with 225 foot high lattice masts. Transmitter building has dark tone on roof.

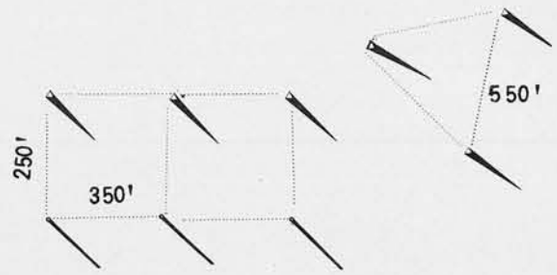
BABELTHUAP, PALAU (R.F. - 1/7500)



BANKOK

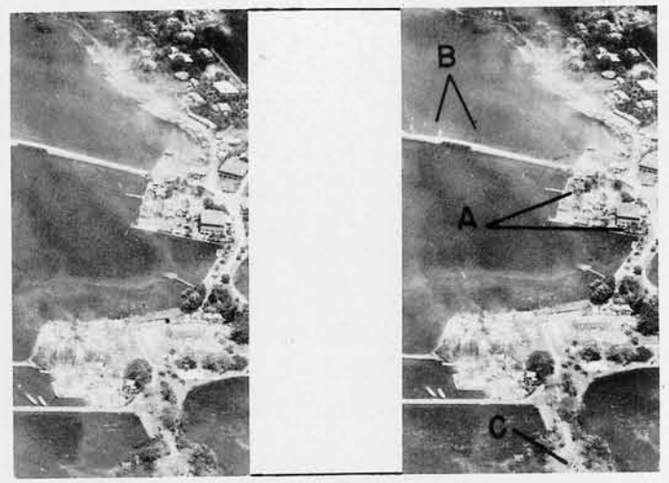


YAP



PALAU

LEFT: Six lattice masts and three stick masts support Low Frequency antennae at this large station on Palau. (See page 2.17) The numerous small stick masts that are present do not show up in this vertical. Cross-shaped building is probably housing for one or more transmitters. All masts shown are between 150 feet and 225 feet in height.

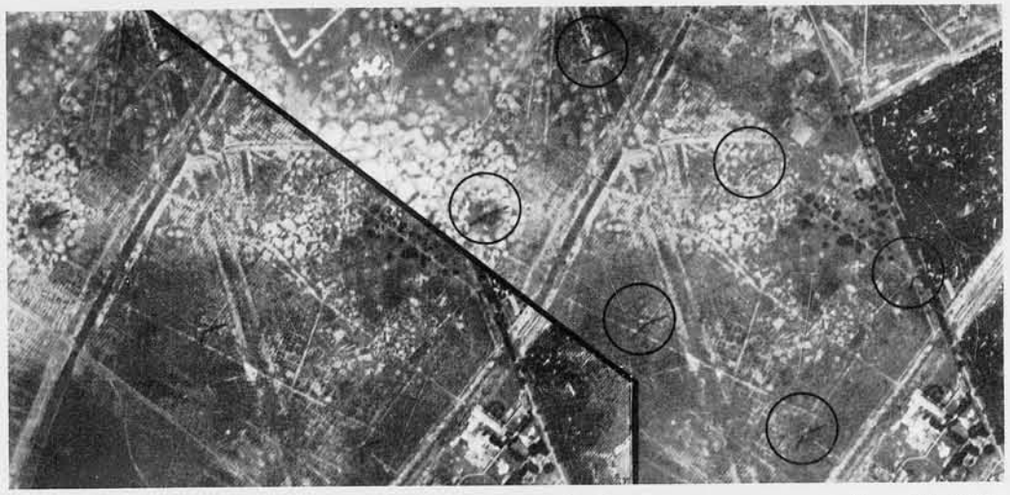


YAP

YAP

"A" - 125 FEET HIGH - LATTICE MASTS.
"B" - TRANSMISSION LINES.
"C" - 60 FEET HIGH SPLICED WOOD STICK MAST.

This station at Yap is probably Low Frequency. The masts are in a triangular pattern with the large, three-storied building in the center (probably housing for transmitter).



SAIGON, F. I. C. (R.F. - 1/13500)

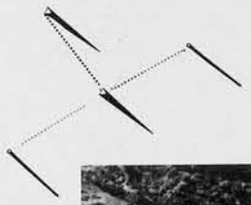
Powerful Low Frequency or Very Low Frequency station under construction at Saigon, French Indo China. This arrangement of high stick masts apparently erected for supporting triatrics, is a typically French design. (Note Bourges Station under "German").

COMMUNICATIONS
LOW FREQUENCY (CONT.)

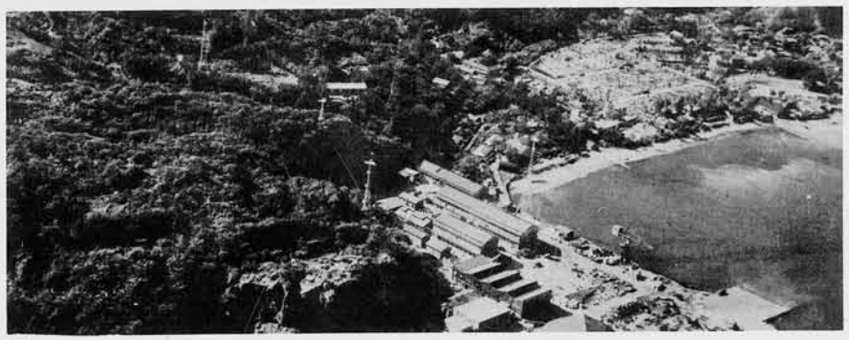
TOKYO, JAPAN

Three lattice masts of a pre-war Low Frequency Station in Tokyo. These masts are about 250 feet high and arranged in an equilateral triangle with 500 to 600 foot sides.

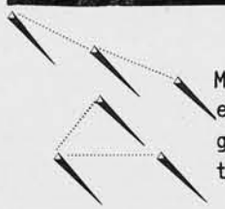
PARAMUSHIRO (R.F. - 1/9000)



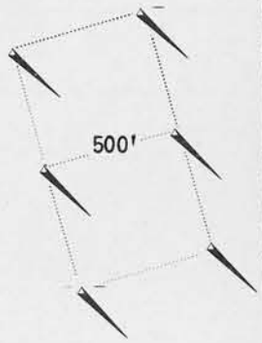
Night photo of station at Surabachi Wan, on the east coast of Paramushiro. The masts, two lattice and two stick, are arranged in a "T" form with the bottom of the "T" pointing toward Tokyo. This station may be directional.

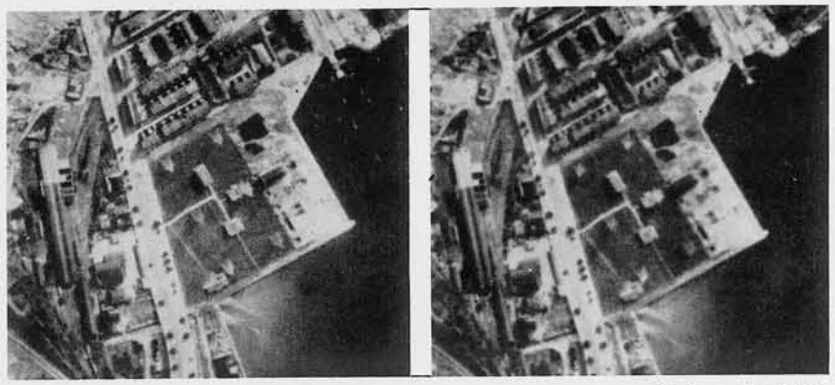


CHICHI JIMA, BONIN IS.



Multi-mast Low Frequency Station at northern end of Chichi Jima. Note effect of hilly topography on design of lattice masts. Note also the seaplane base.





(R.F. - 1/1000)

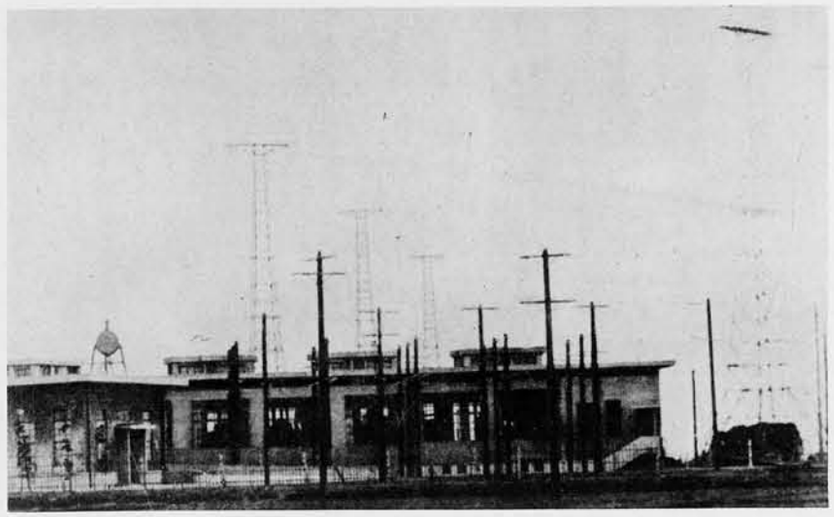
KOWLOON, CHINA

Pre-war British broadcast station at Kowloon, near Hong Kong, now being operated by the Japanese.

(R.F. - 1/15200)

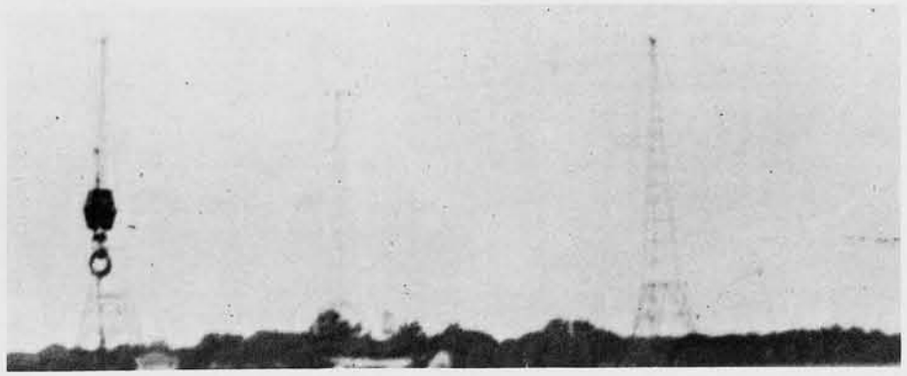
PESCADORES IS.

Medium or Low Frequency Station. Two lattice masts, 100 feet or more in height, are supporting the antennae. This installation appears to be of fairly recent construction.



YOSAMI, HONSHU, JAPAN

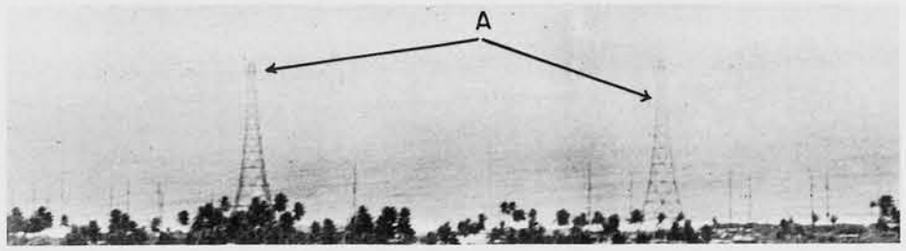
The Yosami station is a Japanese pre-war communications center and broadcasting station.



CAVITE, PHILIPPINES

Above and to the right are views of a Very Low Frequency military station, constructed by the U. S. at Cavite. Although there are now but two masts left of the original three, the Japs appear to have reconstructed and are now using this station.

The masts are 600 feet high, which is taller than any masts of Japanese design yet discovered outside of Japan proper.



KWAJALEIN

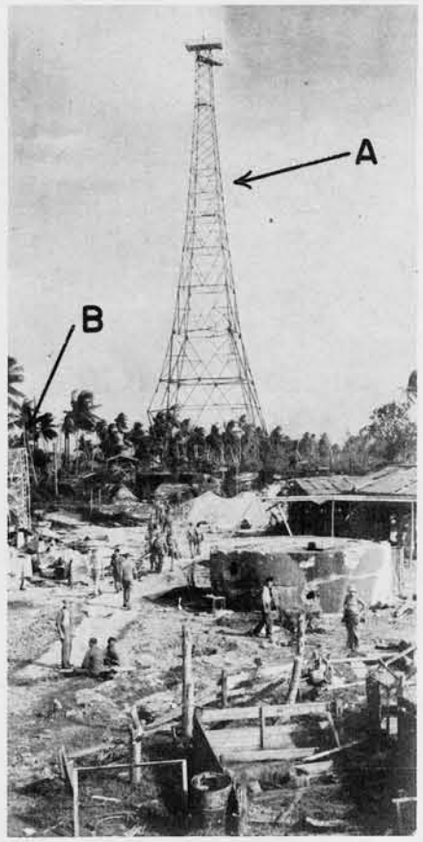
Two lattice masts, 210 feet high, used by the Japanese at Kwajalein. One was damaged during U. S. occupation of the island. The two lattice masts were spaced 500 feet apart.

KWAJALEIN

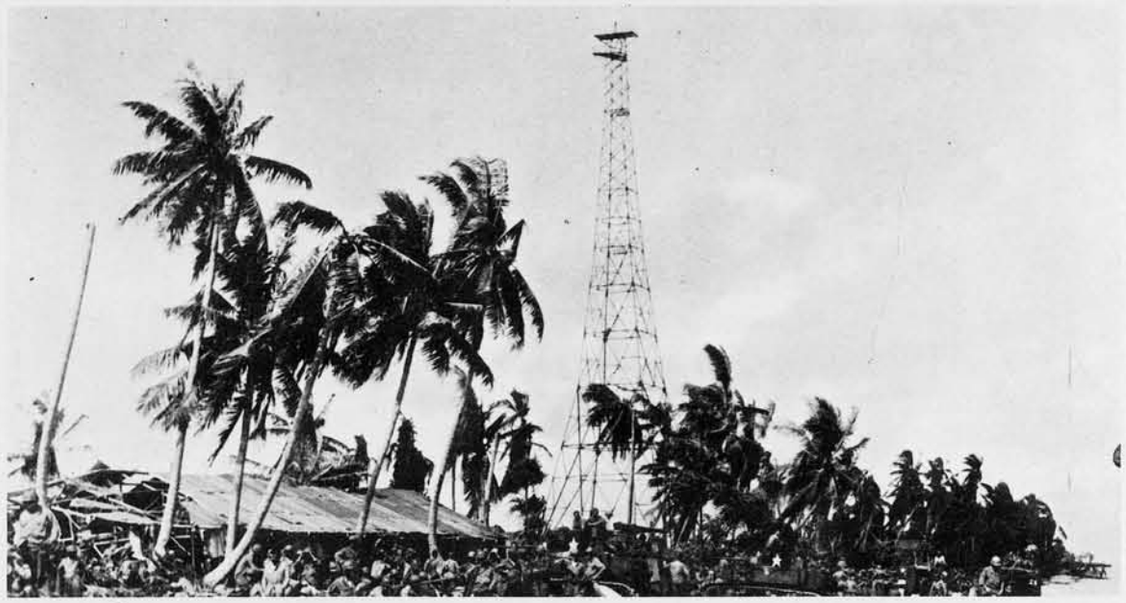
"A" - 210' LATTICE MAST

"B" - SITE OF 210' LATTICE MAST DAMAGED DURING OCCUPATION BY U. S. FORCES.

CAVITE, PHILIPPINES



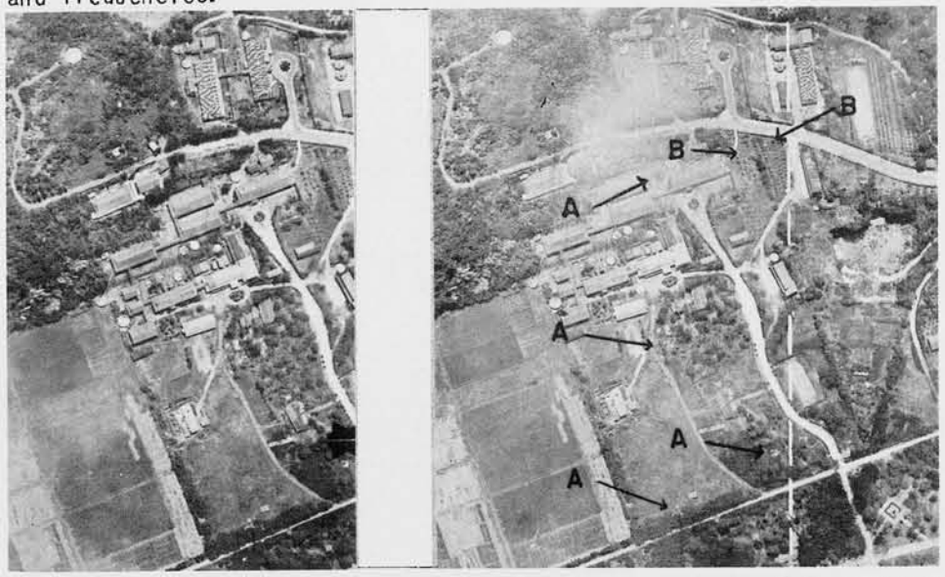
KWAJALEIN



KWAJALEIN

COMMUNICATIONS
COMBINATIONS

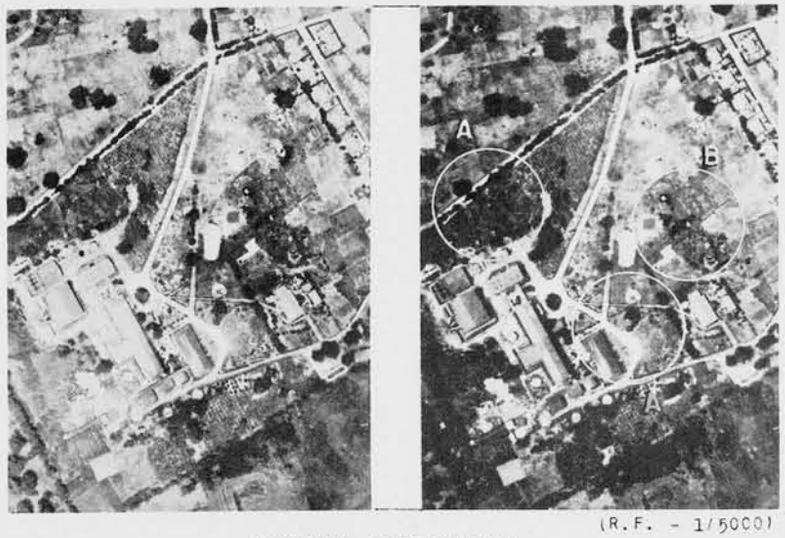
The following two pages of "combinations" are included to make comparisons between the appearance of masts of different types, heights and frequencies.



(R.F. - 1/5000

SAIPAN, MARIANAS

"A" - FOUR 100 LATTICE MASTS. "B" - TWO 50 STICK MASTS.

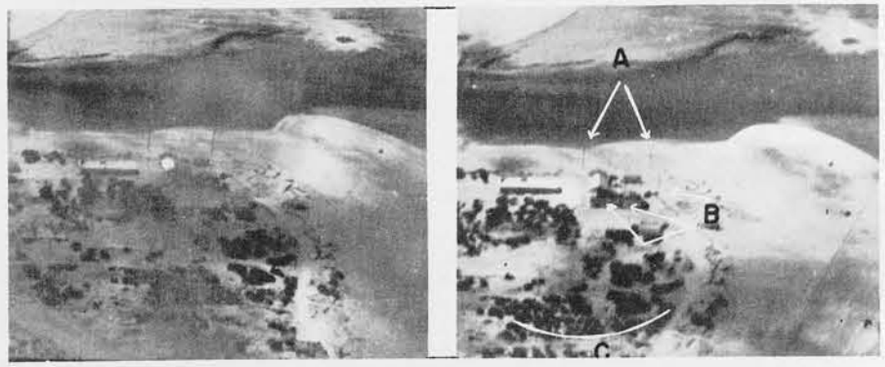


(R.F. - 1/5000)

SAIPAN, MARIANAS

"A" - TWO 125' LATTICE MASTS. "B" - THREE 60' STICK MASTS

When topography is very rough, or when the sun is high at the time of photography, it is difficult to estimate the height of masts.
The two stations above at Saipan probably include Low, Medium, and High Frequency transmitters.
In the lower picture, the three closely spaced stick masts in line are unusual. No report has been received on this from the field, however.



WAKE

(R.F. - 1/2200)

WAKE

"A" - TWO 60' STICK MASTS
"B" - THREE 35' STICK MASTS
"C" - RECEIVING ANTENNAE AND/OR POWER LINES

The above views, when compared, show the value of obliques for picking up detail sometimes missed in vertical coverage. This is a poor example of the capabilities of this method.
Low altitude stereo-obliques, simultaneously exposed, would have great value in electronics interpretation.

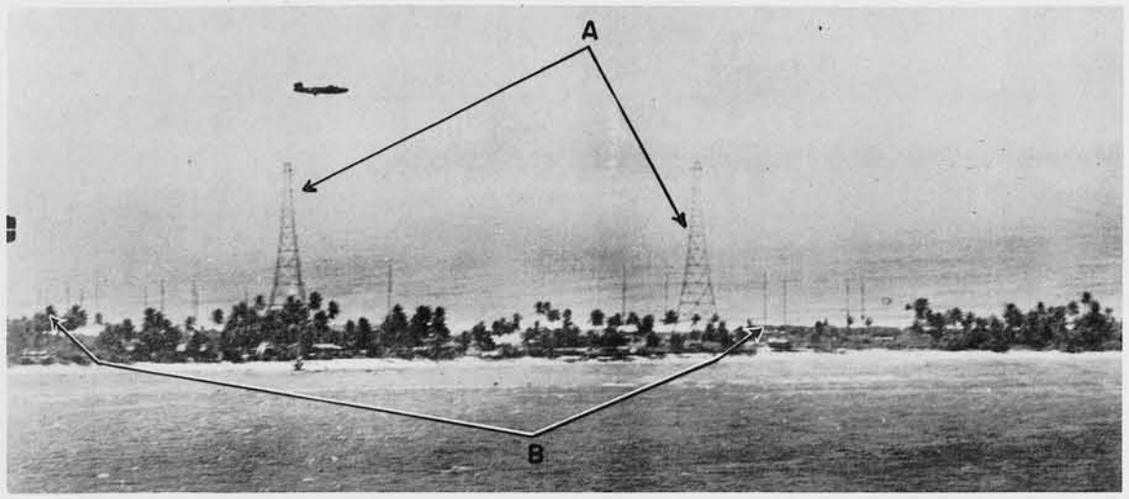
(R.F - 1/14800

TAIHOKU, FORMOSA

"A" - THREE 200' LATTICE MASTS.

"B" - TWO 75'-100' STEEL STICK MASTS.

"C" - TRANSMITTER PROBABLY IN THIS BUILDING.



KWAJALEIN

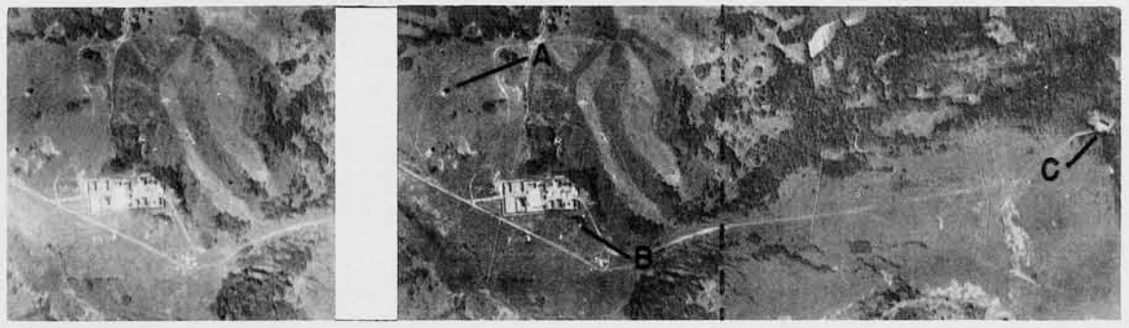
"A" - TWO 210' LATTICE MASTS. "B" - SIXTEEN 60'-75' SPLICED WOOD STICK MASTS.

This station is now in Allied possession. One lattice mast was damaged during occupation.

(R.F. - 1/7500)

OKINAWA

Combined Low Frequency radio communications and weather station at Naha, Okinawa.

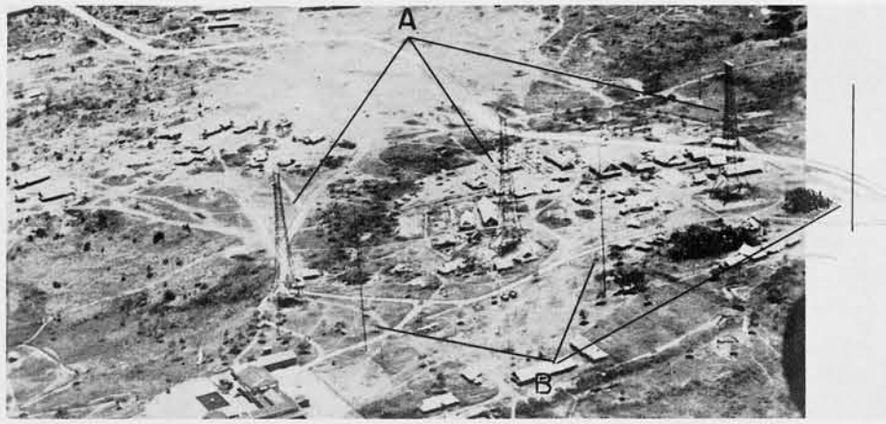


(R.F. - 1/2000)

GARANBI POINT, FORMOSA

"A" - HIGH FREQUENCY D.F. TOWER. "B" and "C" - MEDIUM FREQUENCY COMMUNICATION STATION

Two Medium Frequency Communications Stations in Formosa, spaced 1200 yards apart. One serves as a reporting station for a D.F. aid to navigation.

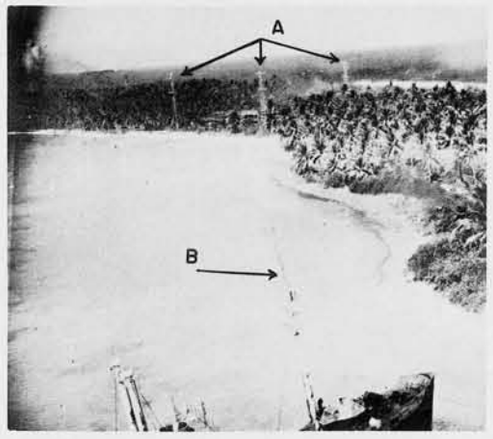


BABELTHUAP, PALAU

"A" - THREE 200' LATTICE MASTS "B" - THREE 150' STEEL STICK MASTS

This is a section of a very large multi-channel Communications Center shown elsewhere in this section. This pattern appears to be directional.

BABELTHUAP, PALAU



JALUIT, MARSHALLS

"A" - THREE 75' LATTICE MASTS "B" - SHIP'S COMMUNICATION ANTENNAE

In the background, can be seen a typical Japanese Military Communications Center with standard concrete building.

COMMUNICATIONS

COMMUNICATION CENTERS

The Japanese have standardized a type of Medium Frequency Communication Center design to such an extent that it is easily recognized, even with very small scale photography. This particular design has been found in about fifteen different localities to date.

The arrangement consists of three 60'-75' Lattice Masts laid out in an equilateral triangular pattern with the communications building in the center of the pattern.

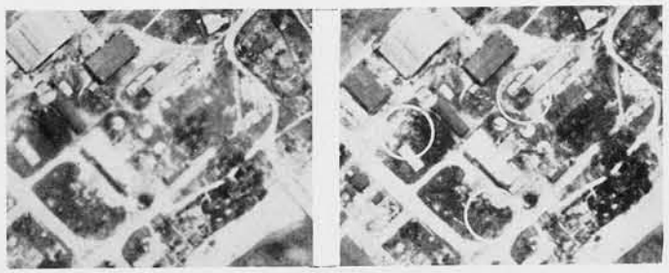
The Communications Building is of modern looking concrete design with flat roof slabs and parapets. It is usually two stories in height and embodies an asymmetrical disposition of roof terraces.

This building houses the transmitter, generators, and storage batteries. In addition are communication offices, living quarters and storage.

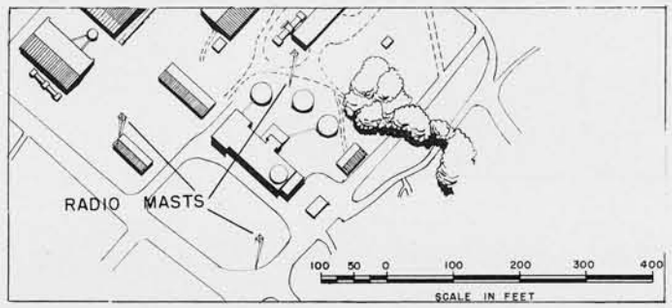
Throughout the Pacific Islands, 20' diameter cisterns (usually three in number) are clustered near the building. Other smaller auxiliary buildings include water cooling tanks (probably for the water-cooled Diesel engines used for generating power), and a concrete oil storage building.

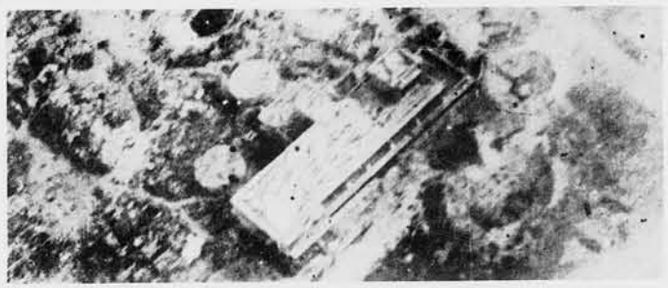
Other types of Communication Centers are also taken up in this section.

All pictures on this page are of a station at Taroa, Maloelap, Marshalls, showing most of the features mentioned. The masts here are spaced 175 feet apart and support the now familiar platforms. These masts are slightly different from the majority used with this type of station in that they are but 60 feet high. The platforms are triangular in shape.

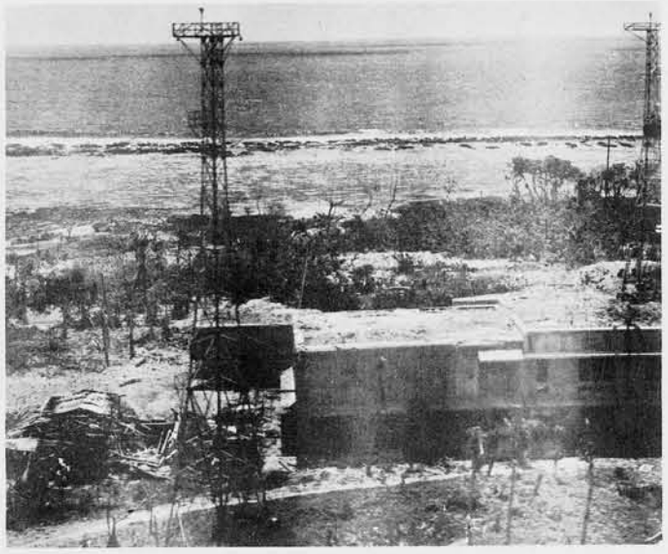


TAROA, MALOELAP (R.F. - 1/5500)





MALOELAP

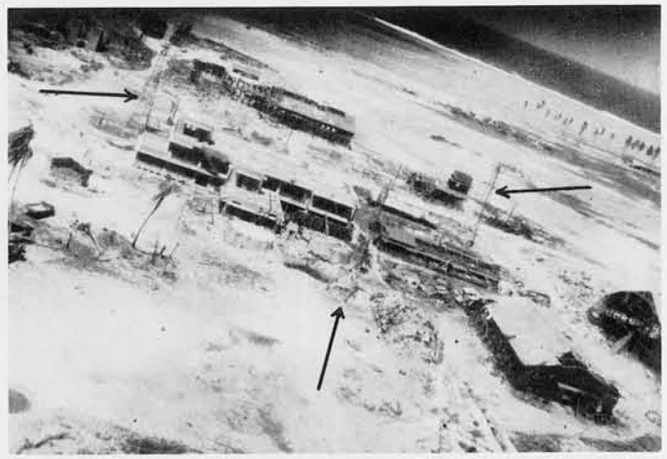


MALOELAP

MALOELAP

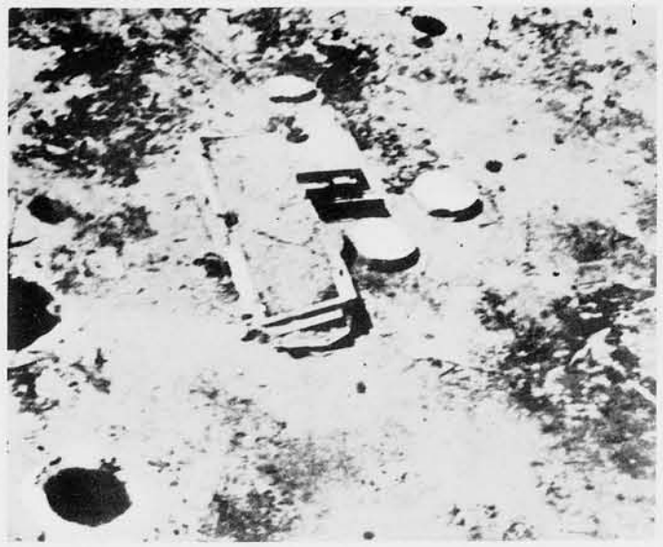
MALOELAP

MALOELAP



MALOELAP

NORTH RADIO STATION, WOTJE

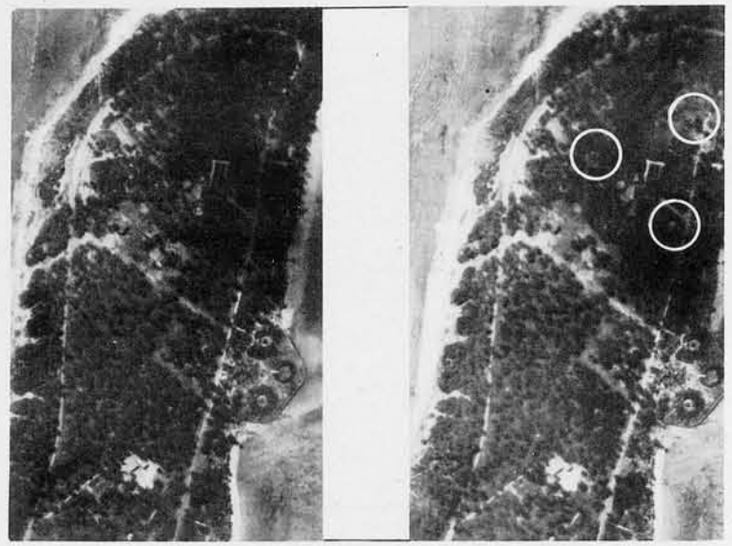


SOUTH RADIO STATION, WOTJE

These stations include the main building, (housing the transmitter, generator, offices etc.), oil storage, water cisterns and cooling tanks.

Although the concrete main buildings vary somewhat in design details, they are sufficiently alike in general form to encourage use of the words "standard type".

The cisterns are not likely to be present when this building is used in areas of adequate fresh water resources. In certain photos, the pipes leading from the roof, where water is collected, to the cisterns, are clearly visible.



(R.F. - 1/10000)

WOTJE, GILBERTS

SOUTH RADIO STATION, WOTJE

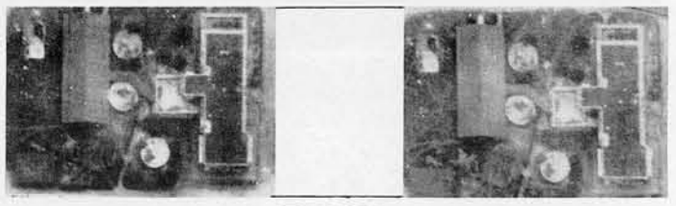
WOTJE, GILBERTS

WOTJE, GILBERTS

Oblique showing three 75 foot lattice masts with platforms and concrete building of typical design.

"A" - THREE LATTICE MASTS TYPE L-5

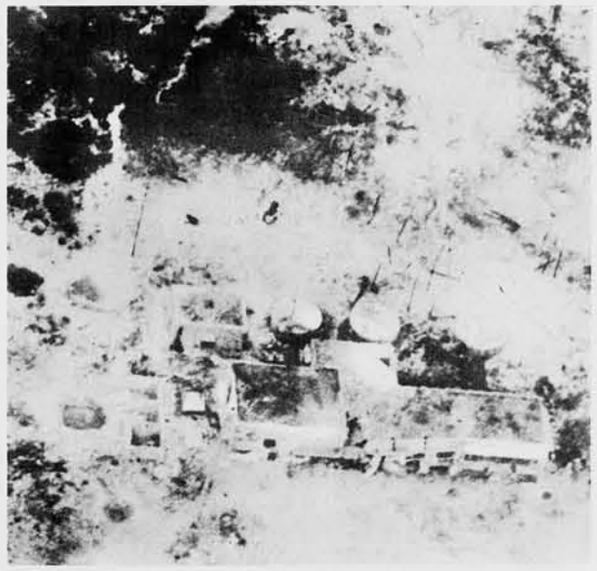
"B" - VISUAL SIGNALLING LIGHT



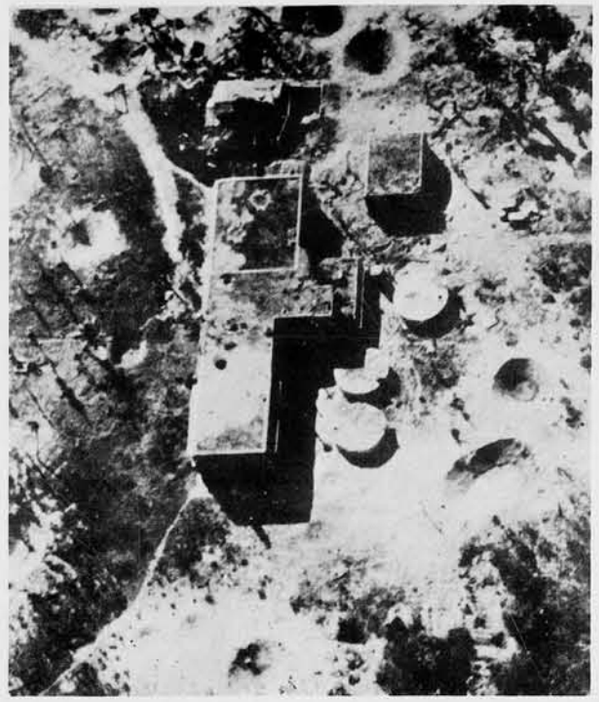
TINIAN (R.F. - 1/2500)

Detail of Center at Tinian reveals building very similar to that at Taroa, Maloelap.

COMMUNICATIONS
COMMUNICATION CENTERS (CONT.)

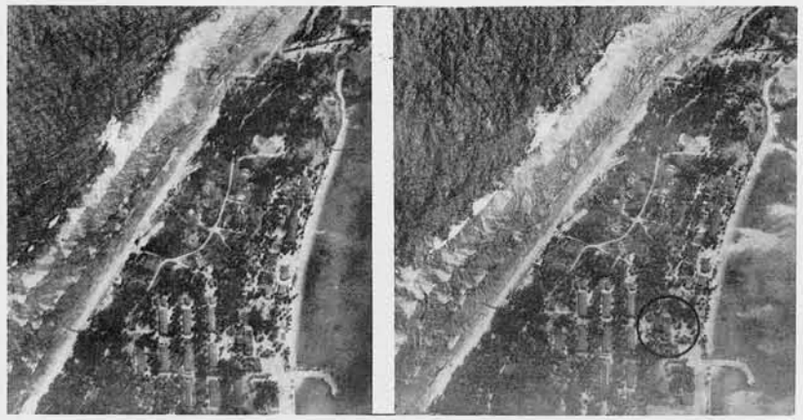


JALUIT, MARSHALLS



PIGEEYATTO, MALOELAP, MARSHALLS

Standard building, water cooling tanks, oil storage building, and cisterns are all present. The cellular construction in the water-cooling tank building is visible in the partly destroyed example above.

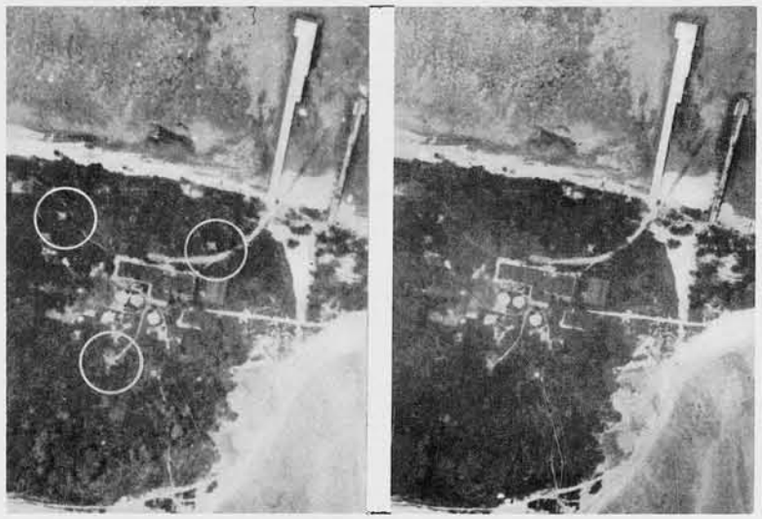


(R.F. - 1/11000)

JALUIT

In these pictures of Jaluit Communications Center, in which the location of masts is very difficult to determine, the standardized type of concrete building serves well for identification purposes.

All of these concrete buildings contain fairly powerful transmitters in the Medium Frequency band. The approximate reliable range is 500 miles, but they may transmit a great deal further, especially at night.

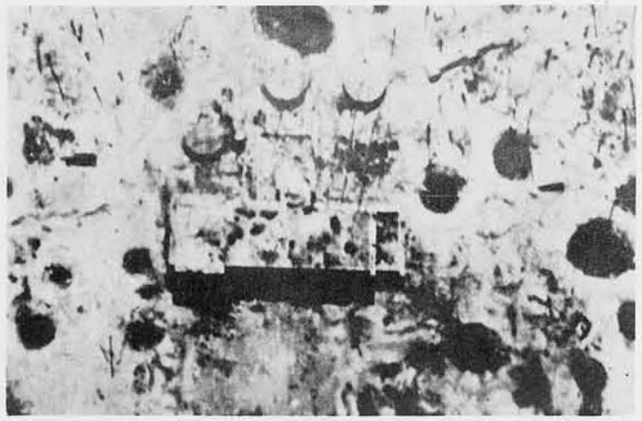


(R.F. - 1/2500)

PIGEEYATTO, MALOELAP

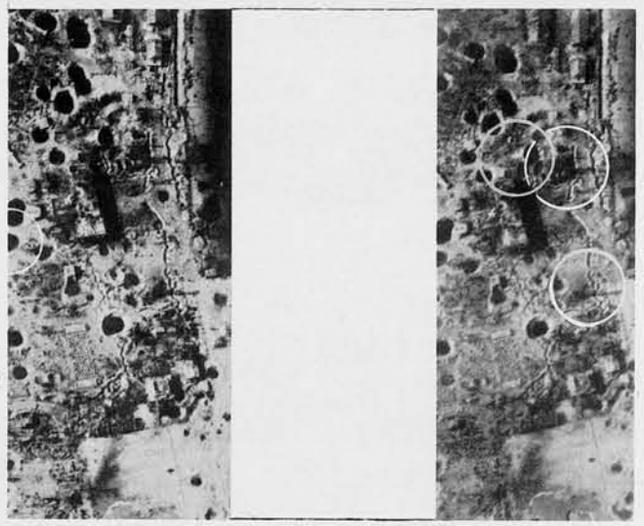
Another Medium Frequency Communications Center at Maloelap. This station is located on Pigeeyatto Island.

Here the masts are of the same type and dimensions as at Taroa, i.e. 60 feet high, 175 foot spacing, and a single triangular platform at the top.



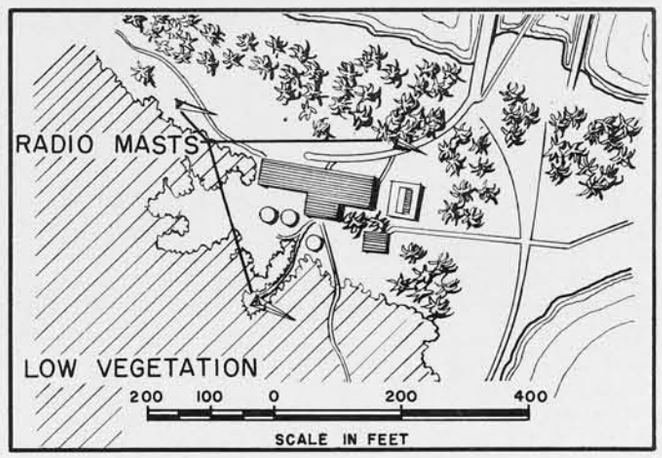
(R.F. - 1/1300±)

JALUIT

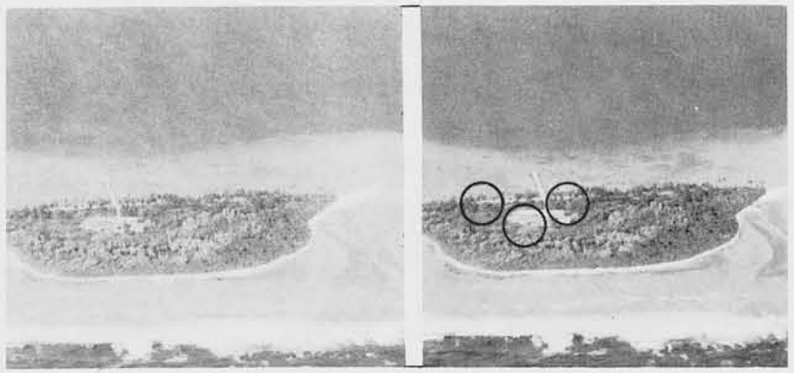


(R.F. - 1/4000)

JALUIT



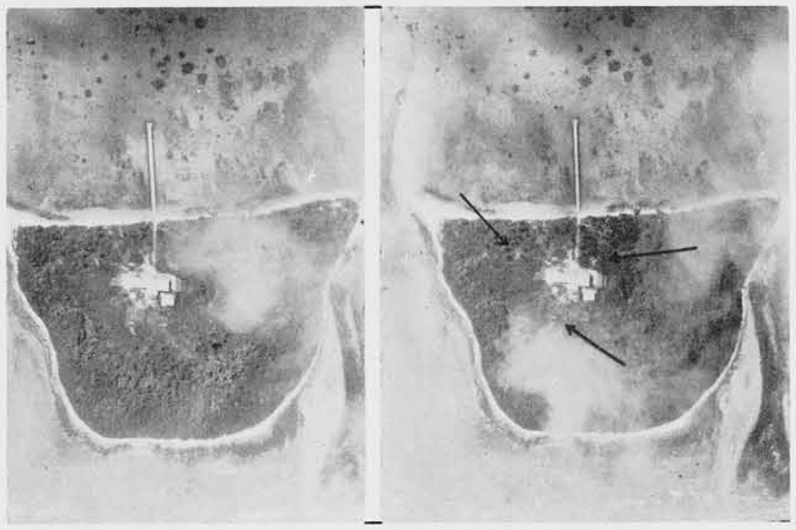
PIGEEYATTO, MALOELAP



ENNUBIRR, KWAJALEIN, MARSHALLS

The pictures and plans on this page are of a Medium Frequency Communications Center on Ennubirr Island, Kwajalein Atoll, Marshall Islands.

Apparently, the sole military use of this particular island was radio communication, and the "Standard" buildings and arrangement were employed.

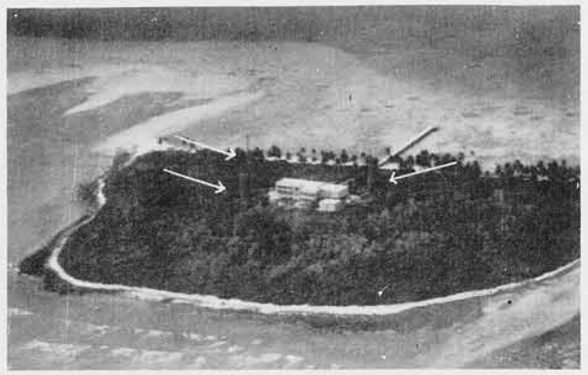


(R.F. - 1/10000)

ENNUBIRR

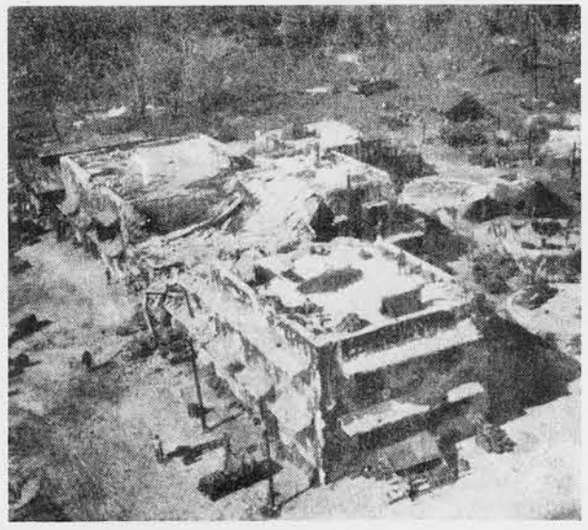
This installation has three lattice towers, 75 feet high, which are spaced 350 feet apart. This indicates that it is a fairly powerful station in the Medium Frequency band (.3 to 3 mcs.) and probably has a reliable range of 500 to 800 miles when operating under normal conditions.

The Ennubirr Station is one of several communication stations at Kwajalein, which are mostly High and Medium Frequency, with one probable Low Frequency.



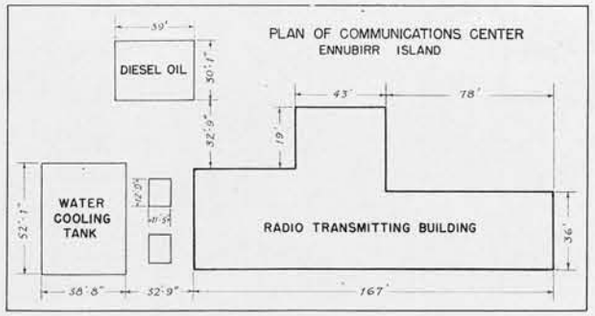
ENNUBIRR

The buildings are as follows: main concrete communications building, concrete oil storage building and three 20 foot diameter concrete cisterns. A long pier for transportation and supplies was necessary because of the shallow water over the coral reefs. This is evidently the only means of access to the island.



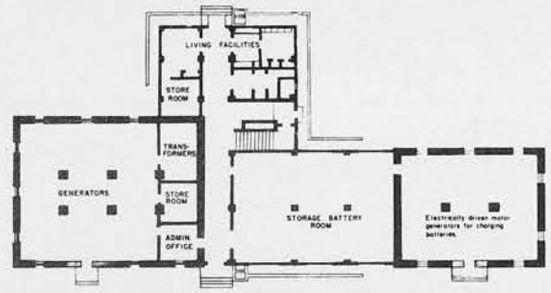
ENNUBIRR

From these examples it can be more forcibly realized the extent to which the Japanese have developed a Military Communication network throughout their empire. Ample and reliable communication facilities, throughout widely dispersed areas and involving great expanses of water, are an imperative need of the Japanese military machine hence their great reliance on radio.

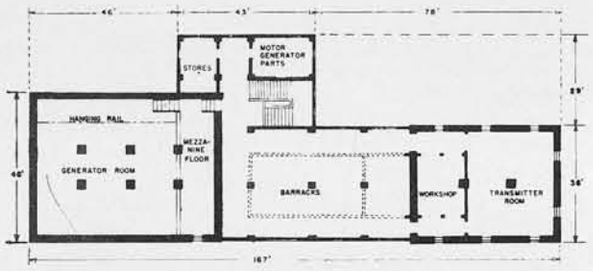


PLOT PLAN OF ENNUBIRR

The two small rectangles between the transmitting building and the water cooling building may represent exhausts for the Diesel engines. Water cooling tank buildings are built of wood with pitched roof and monitor. Oil storage buildings are usually concrete with flat roofs.



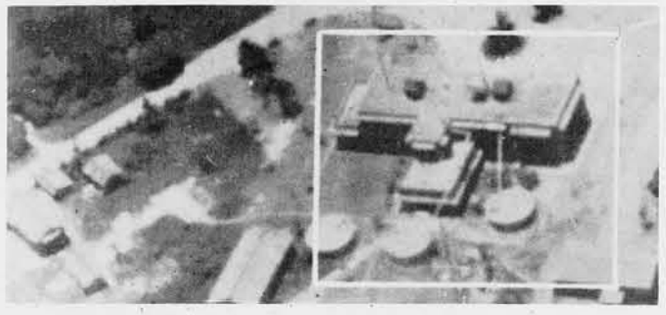
FIRST FLOOR PLAN



SECOND FLOOR PLAN

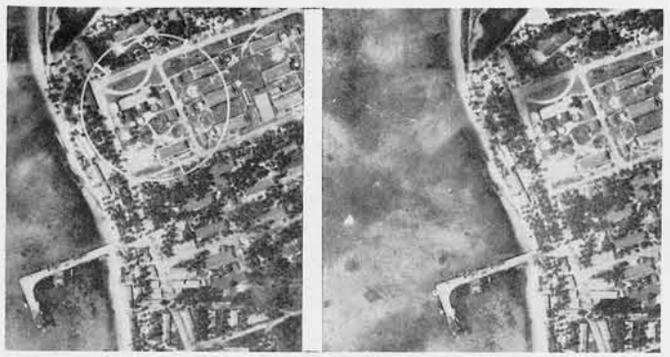
The first floor contains most of the services, engines and heavy equipment. The structure is heavy and well-built of reinforced concrete. The second floor contains most of the electrical equipment (such as the transmitter, which is most vulnerable and difficult to replace), and also barracks for the crew. The generator room ceiling is two stories in height.

COMMUNICATIONS
COMMUNICATION CENTERS (CONT.)



PALAU

This station at Pelelieu Island, Palau, is apparently the 75 foot mast, Medium Frequency standard type. However, there appear to be two additional 30 foot masts erected on top of the building. These latter masts probably carry antennae for High Frequency Communication. The absence of the water cooling and oil storage buildings suggests that power may be fed to this point from a remote station.

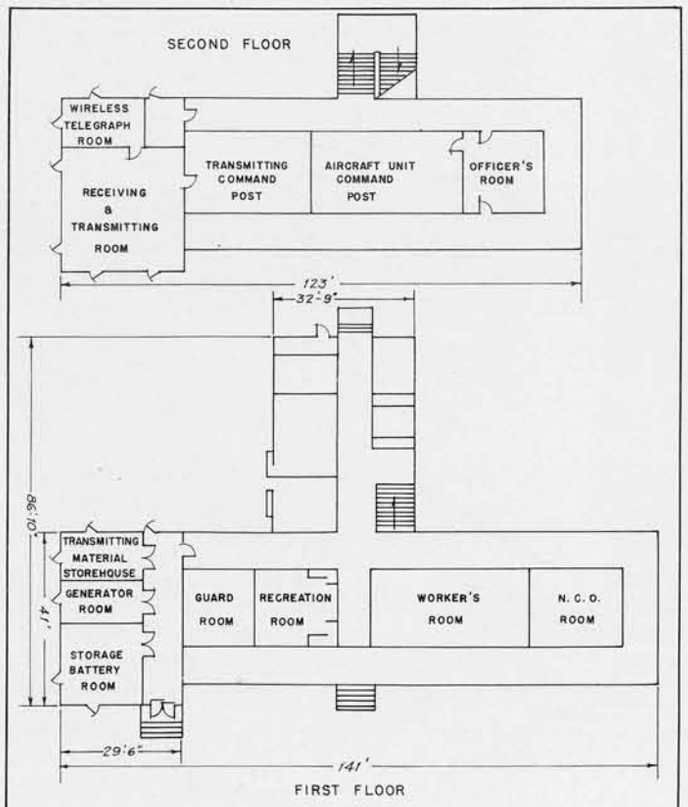


(R.F. - 1/10000)

NAMUR, KWAJALEIN

This building is probably used as a command headquarters in addition to a message center.

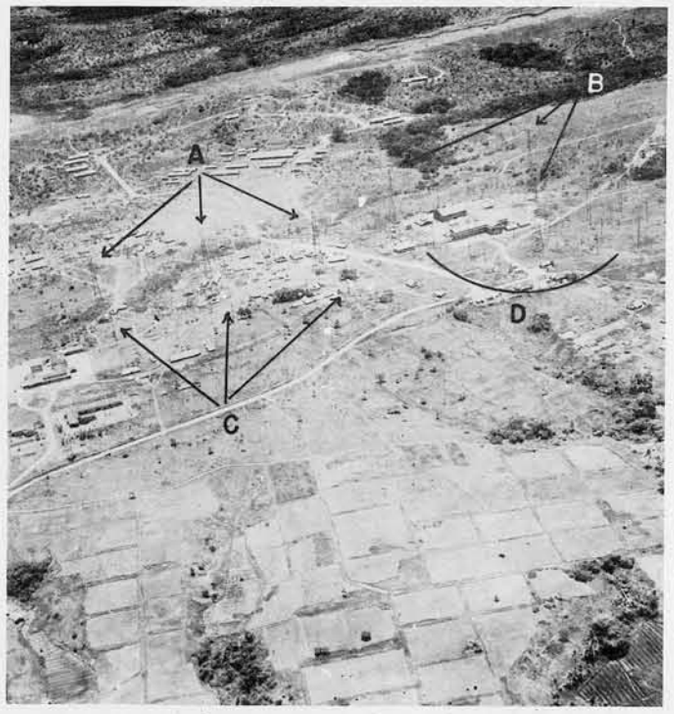
The "Headquarters Building" on Namur Island, Kwajalein, is mainly a Communications Center, serving also as a command post, (which is true of many examples of this standardized type concrete building). This station transmits at Medium Frequency.



HEADQUARTERS BUILDING
NAMUR ISLAND

PALAU

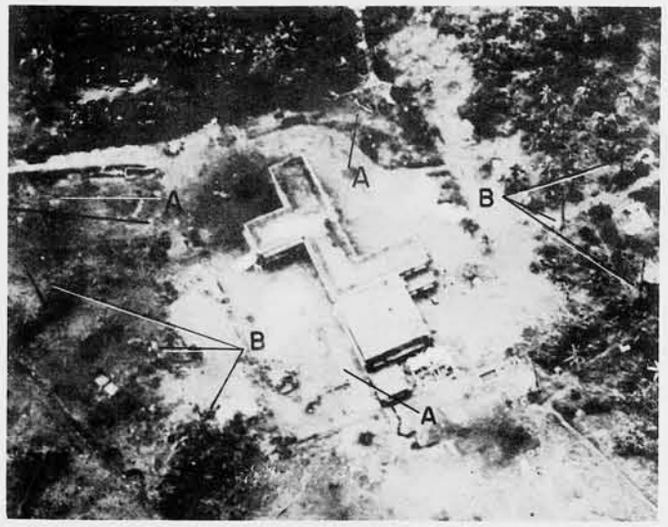
One of the largest Japanese Communication Centers seen to date is this one on Babelthuap Island, Palau. Such a station may operate on many frequencies, ranging from High to Low. It may be best described as a Multi-channel Communication Center.



PALAU

"A" - THREE 200' LATTICE MASTS (QUADRUPED)
"B" - THREE 250' LATTICE MASTS (TRIPOD)
"C" - THREE 150' ± STEEL STICK MASTS
"D" - SEVENTEEN (VISIBLE) WOOD STICK MASTS 50'-75' IN HEIGHT AND ONE STEEL STICK MAST, 150' HIGH.

Small poles are power poles. All other masts visible probably support transmitting antennae.



TRUK

This station, because of its more elaborate mast system and the larger, more complex form of the communications building, appears to be of a multi-channel type, operating on Low, Medium, and possibly High Frequencies.

"A" - THREE 125' LATTICE MASTS
"B" - SIX 50' - 60' SPLICED WOOD STICK MASTS

CONCRETE - 25' x 35'

ABOVE: Two examples of bomb proof communications and command posts. These are quite small as compared with the concrete Communications Center Buildings. The design of heavy reinforced concrete

CONCRETE - 14' x 60'

varies considerably. The transmitters in these posts are probably high and medium frequency and are used in connection with ground troops and A. A. and C. D. batteries.

GUAM

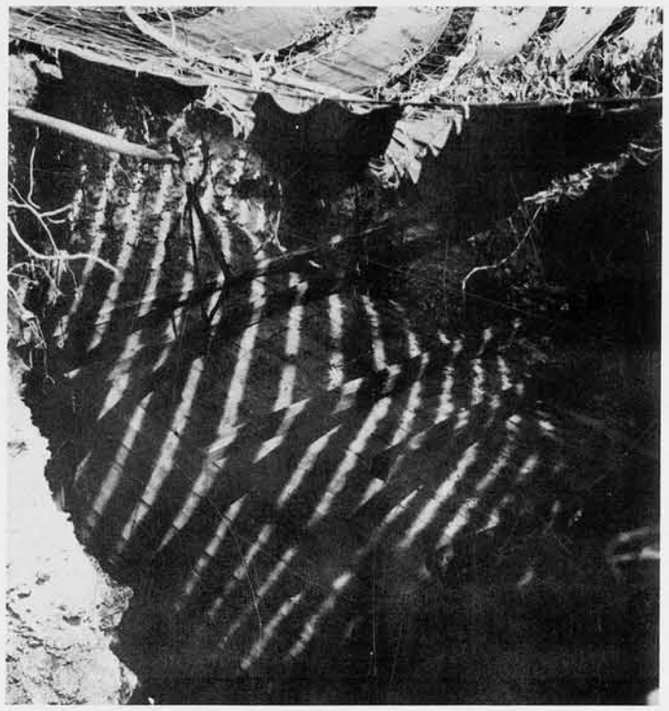
Interior view of concrete vault shown at bottom of page. Inside dimensions are 13' x 45'.

GUAM

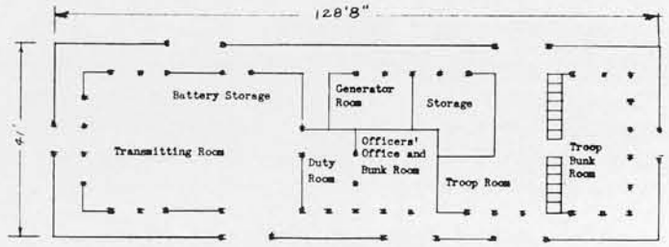
Transmitter in small buried communications center. Observation of tracks and presence of antenna masts are clues to this type of station.

ENTRANCE

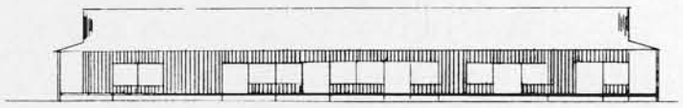
Entrance to completed vault is shown here. Eight feet of coral backfill has been placed on top of vault which is 18 feet wide by 50 feet long (outside dimensions). Concrete is 2½ feet thick.



Exterior view of buried concrete barrel vault Communications Center at Guam, designed mainly for local ground force communication while under attack. These types are extremely hard to locate on aerial photos and are strongly resistant to bomb damage. Note camouflage during construction.



PLAN

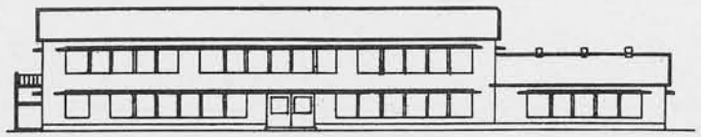


ELEVATION

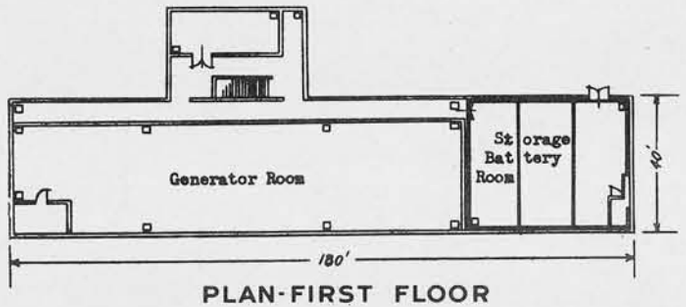
The standard Japanese prefabricated barracks building is used as a communications center in several instances. When radio masts are visible near barracks buildings, there is a good chance that the barracks nearest to them contains the transmitter. Transmitting rooms are invariably at the end of a building, and on the second floor, if a two story structure.

COMMUNICATIONS

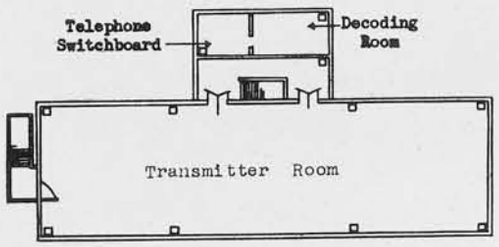
COMMUNICATION CENTERS (CONT.)



FRONT VIEW



PLAN-FIRST FLOOR



PLAN-SECOND FLOOR

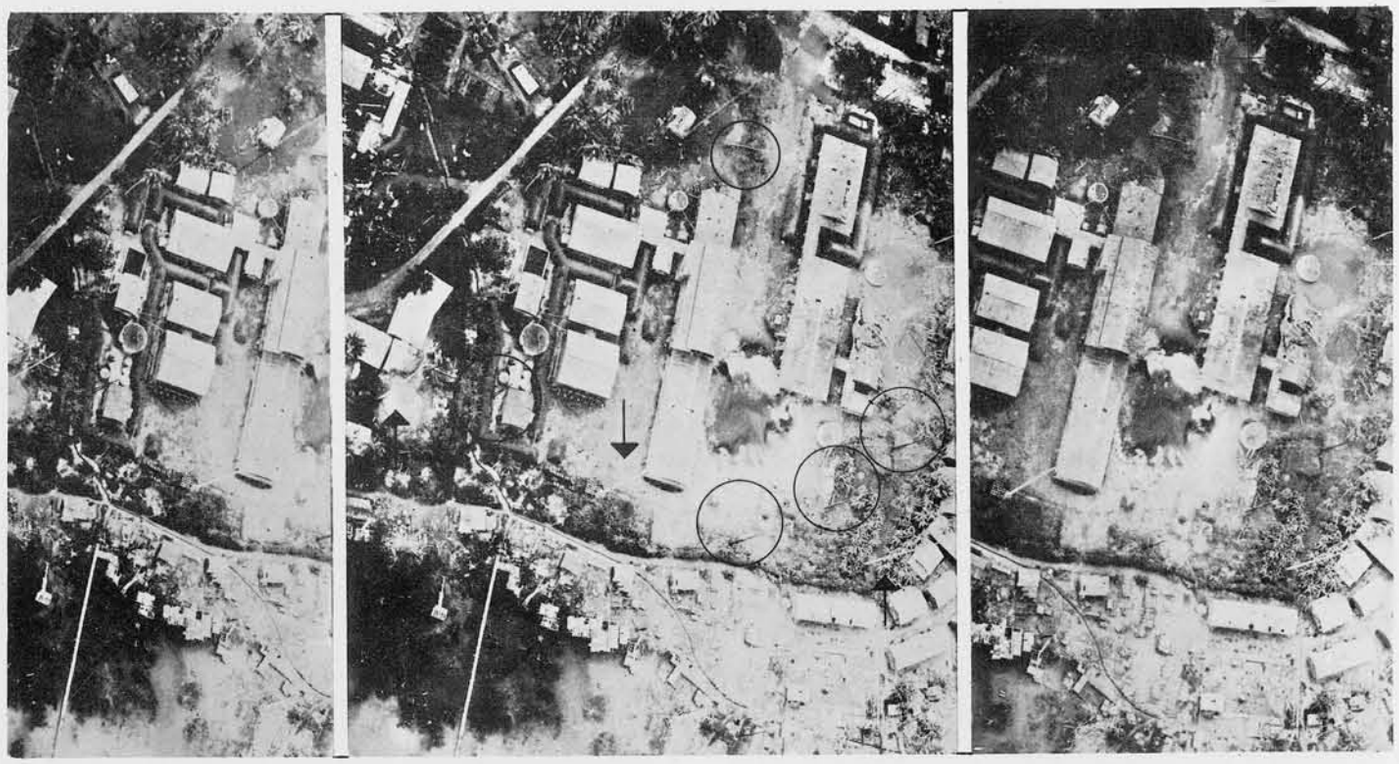
Another type of communications center which is apparently a development of the prefabricated barracks building. This structure is two-storied, with the transmitter on the second floor.

The design of Communication Center, at the southwest tip of Dublon Island, is curiously jumbled and makeshift for a station that is apparently quite powerful.

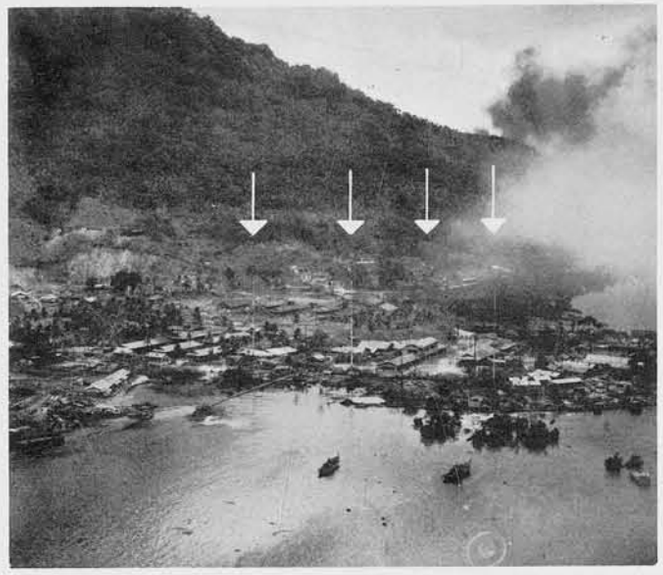
High and Medium Frequency transmitters are likely to be present, the latter with fairly good range. The tallest stick masts are 100 feet high; the spliced wood stick masts are about 60 feet.

FAR RIGHT: This Center, on the north side of Dublon town, utilizes three typical 125 foot lattice masts with platforms and an informal arrangement of stick and spliced wood stick masts. There is very likely a low frequency transmitter present in connection with the lattice masts.

All of the pictures on this page are examples of the use of prefabricated barracks-type buildings in connection with Communication Centers. Most are one story in height and are 38 feet wide, including roof overhang.

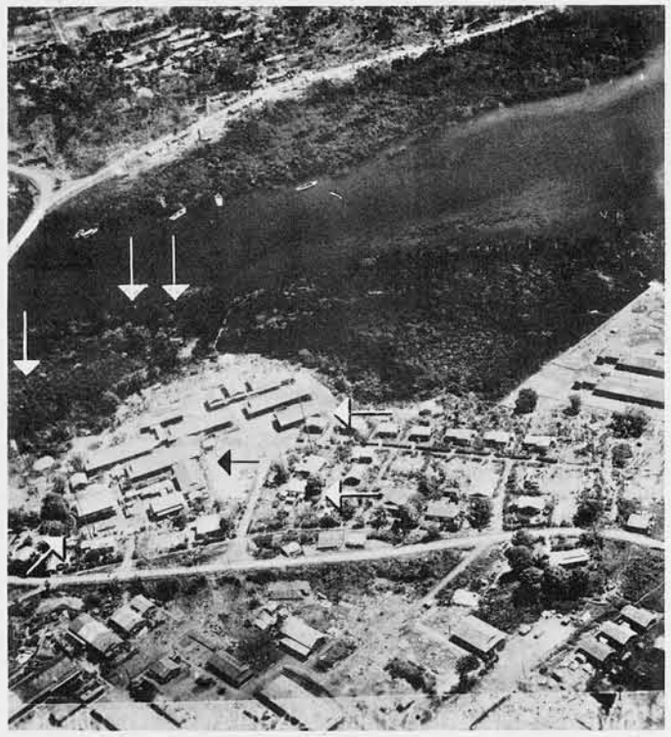


S. W. DUBLON, TRUK



S. W. DUBLON, TRUK

This communication center at Truk is a multichannel station operating at various frequencies including long range, medium or low frequency. The informal, jumbled nature of the group is not very typical of the larger stations.



DUBLON TOWN, TRUK

COMMUNICATIONS
WEATHER STATIONS

Japanese military Weather Stations are fairly easily recognized in small scale photography by the following features:

1. 50'-60' steel (sometimes wood) tower containing wind instruments for recording speed and direction and/or low wooden platform constructed on top of roof of main building.

2. Three small white-painted instrument houses, usually in line. These are roughly 3' to 5' square - but show up very plainly because of their pure white color.

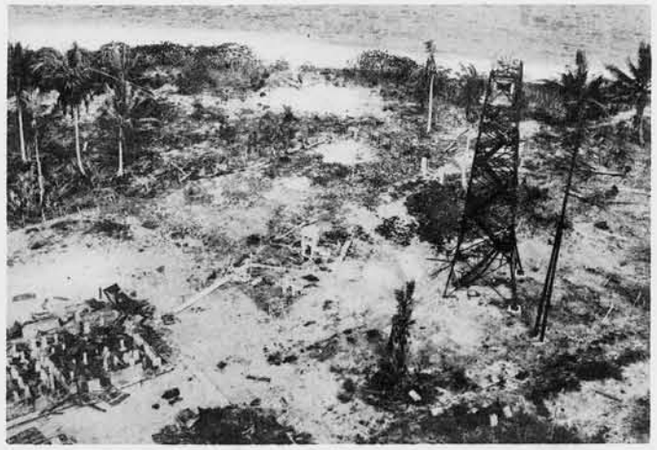
3. If near water, may have tide guage house.

4. Main building for transmitting, offices, quarters, etc.

5. Other buildings present are likely to be barracks, generator building, oil storage and water storage.

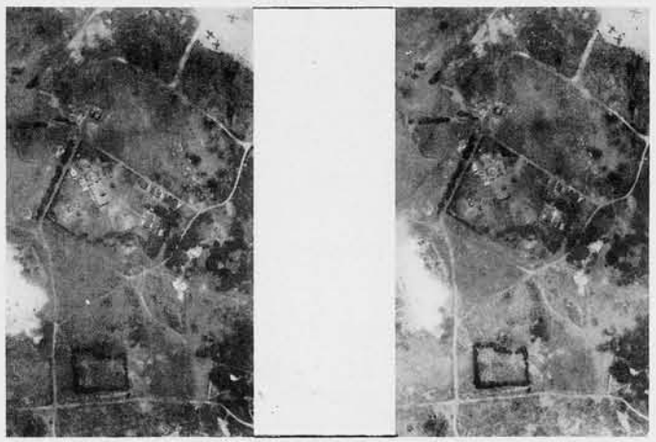
6. Two spliced wood stick masts supporting antennae for reporting station.

BELOW: This weather station at Yap is unusual in that four stick masts are used for communications. In most stations, only the two spliced masts are present.



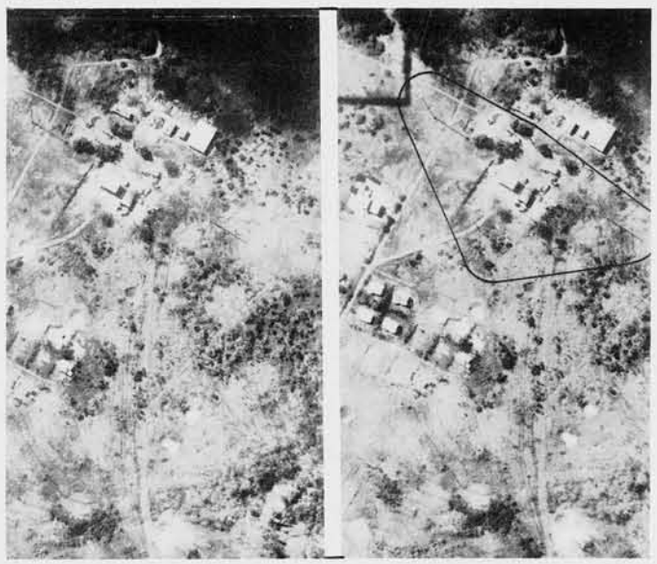
NAMONUITO, CAROLINES

NAMONUITO, CAROLINES

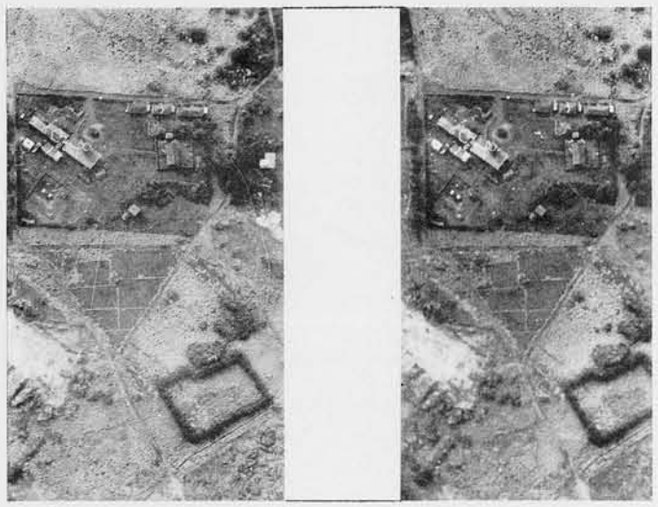


IWO JIMA, KAZAN (R.F. - 1/9100)

MAUG, MARIANAS (R.F. - 1/4000)



YAP (R.F. - 1/5000)



IWO JIMA, KAZAN (R.F. - 1/5000)

MAUG, MARIANAS

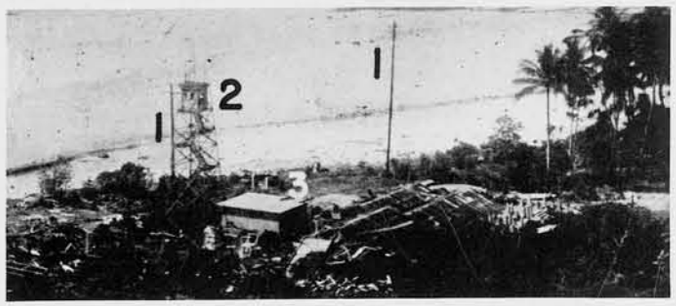
COMMUNICATIONS
WEATHER STATIONS (CONT.)

KAVIENG, NEW IRELAND

"A" - SPLICED WOOD STICK MASTS
"B" - PROBABLE GENERATOR BUILDING
"C" - WEATHER INSTRUMENT HOUSES

UJAE, MARSHALLS

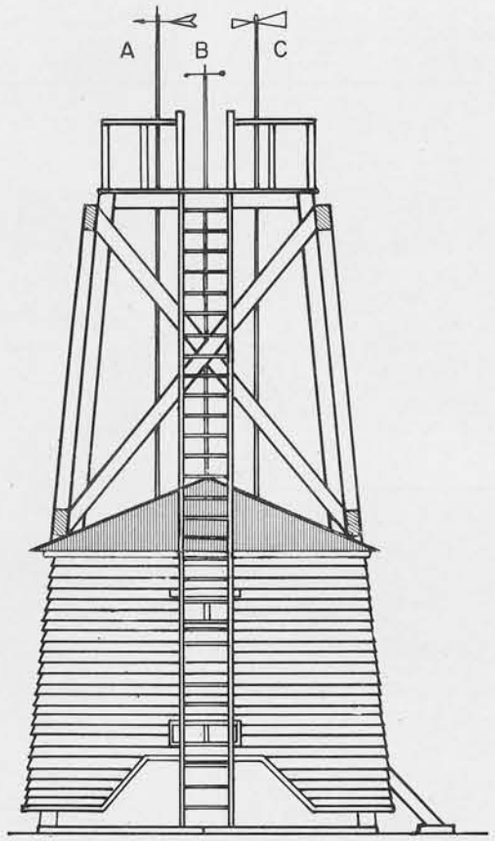
"A" - STICK MAST
"B" - PROBABLE GENERATOR BUILDING
"C" - TOWER FOR WIND RECORDING INSTRUMENTS
"D" - WEATHER INSTRUMENT HOUSES
"E" - TIDE GAUGE HOUSE



KAPINGAMARANGI, CAROLINES

"1" - TWO 75 FEET HIGH STICK MASTS WITH CROSS PIECES AT TOP.
"2" - WEATHER STATION TOWER.
"3" - PROBABLE GENERATOR BUILDING.

A tide gauge house is probably present.

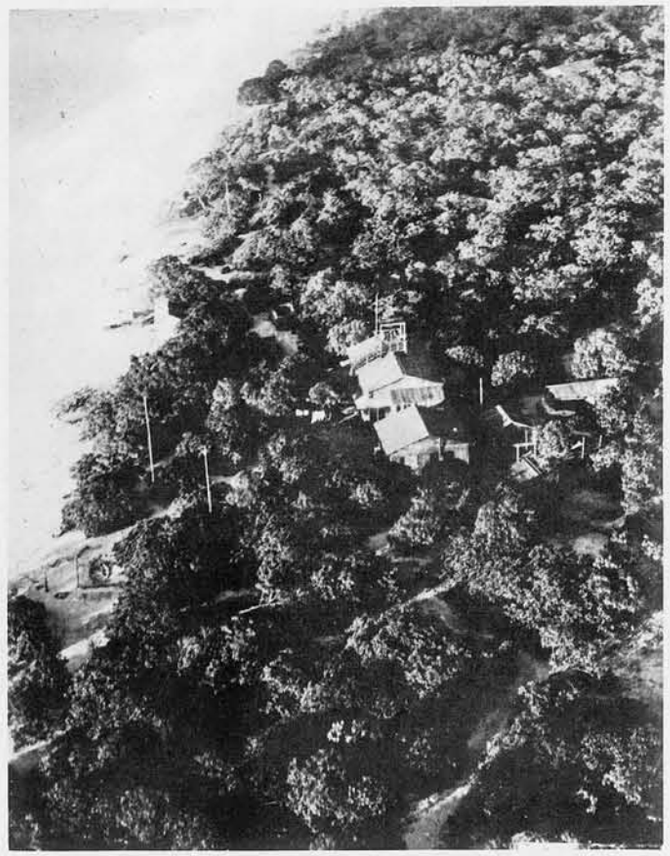


ELEVATION

Drawing of a Japanese Weather Station tower showing instruments common to this installation.

"A" - WEATHER VANE.
"B" - ANEMOMETER.
"C" - VENTURI TUBE FOR RECORDING WIND VELOCITY.

NGULU, CAROLINES

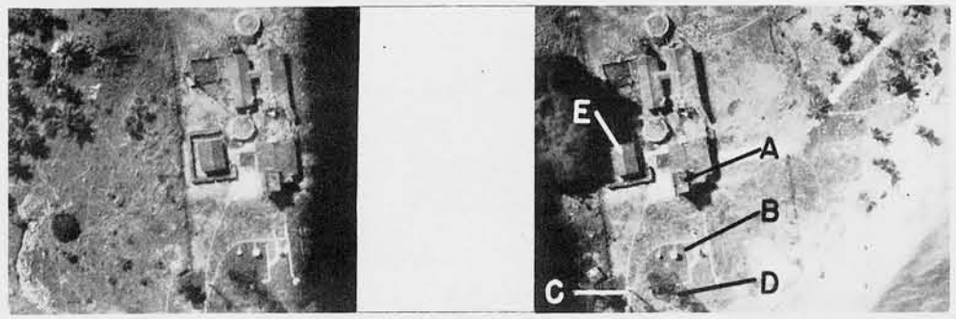


TAONGI, MARSHALLS

This weather station at Taongi is identified by the tower platform atop the main building and by the presence of radio masts.

A tide gauge house is probably present.

NGULU, CAROLINES



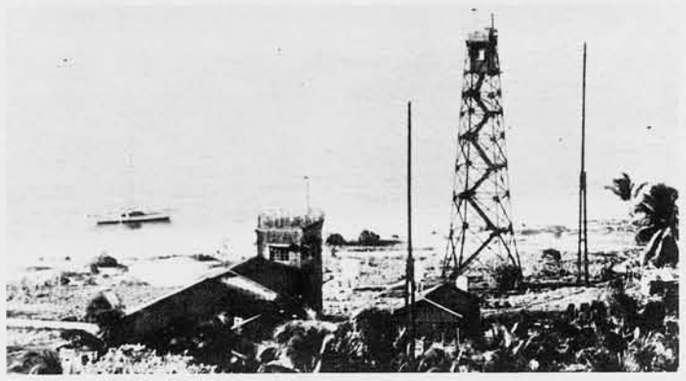
(R.F. - 1/2000)

RONGELAP, MARSHALLS

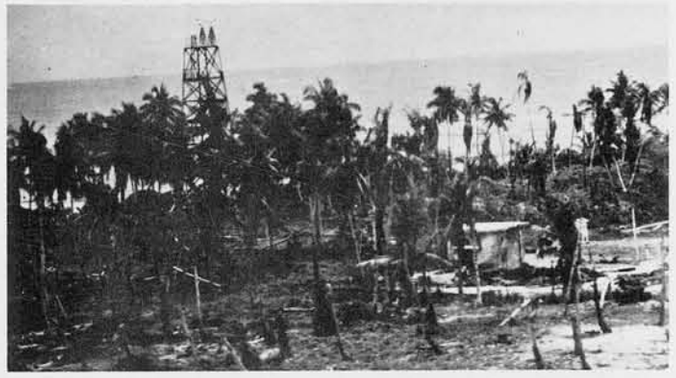
"A" - TOWER PLATFORM
"B" - WEATHER INSTRUMENT HOUSES
"C" - STICK MAST FOR RADIO
"D" - STEEL TOWER
"E" - PROBABLE GENERATOR BUILDING

"A" and "D" are both used for recording wind direction and velocity. Note strong pattern created by weather instrument houses. These houses contain instruments for determining temperature and barometric pressure and include recording barographs. They are always painted white in order to get standard constant readings.

PINGELAP, MARSHALLS



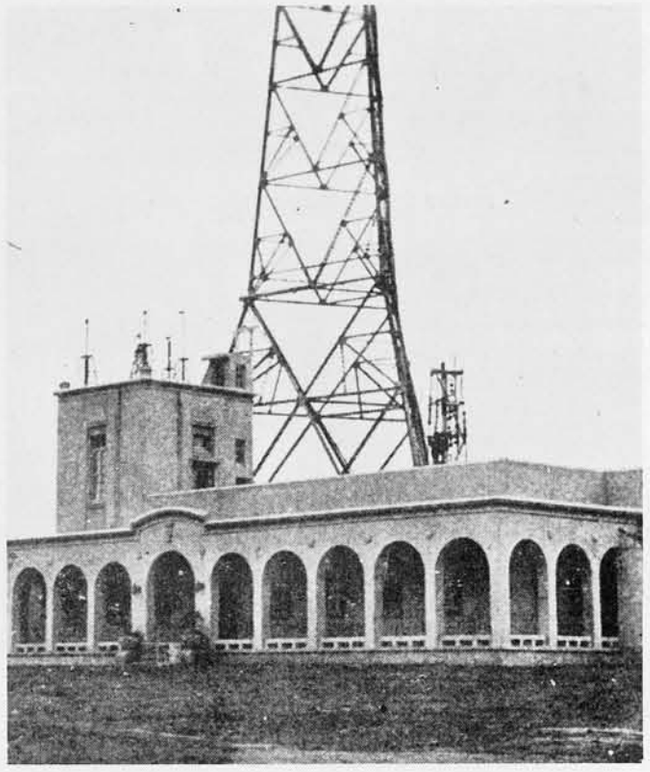
RONGELAP – BEFORE



ULITHI, CAROLINES

RONGELAP – AFTER

ULITHI, CAROLINES



NAHA, OKINAWA

Example of a large pre-war Weather Station

COMMUNICATIONS

GERMAN

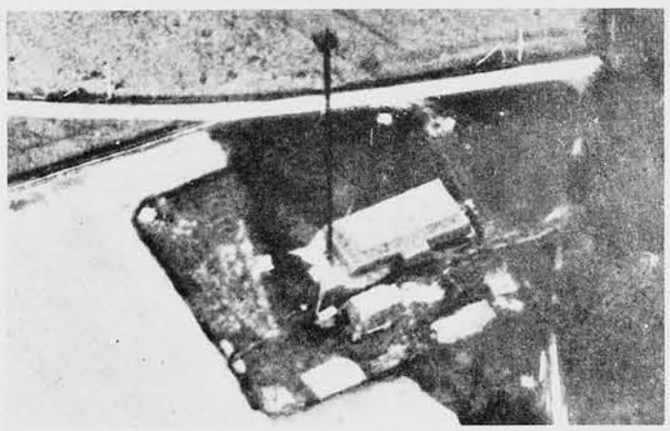
German Radio practice differs in many ways from the Japanese, and examples are shown on these two pages to illustrate this fact.

Most German radio is likely to be in the High or Very High Frequency bands, although Medium Frequency is used also. Very few Low Frequency stations are found, however.

A collection of tall, (300 feet high) lattice masts is likely to mean a powerful short wave transmitter, rather than Low Frequency as would be the case in Japanese stations.

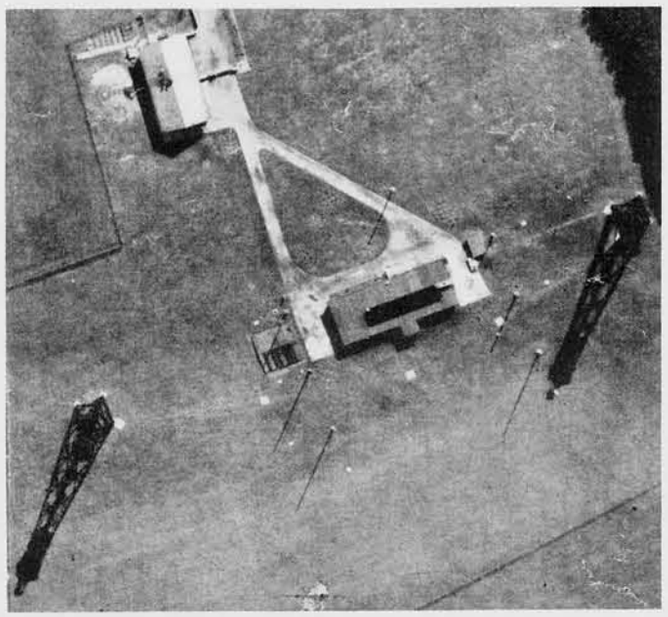
The Germans also employ point to point relay stations at V.H.F. (Decimeter Stations) and High Frequency directional layouts.

DECIMETER STATION

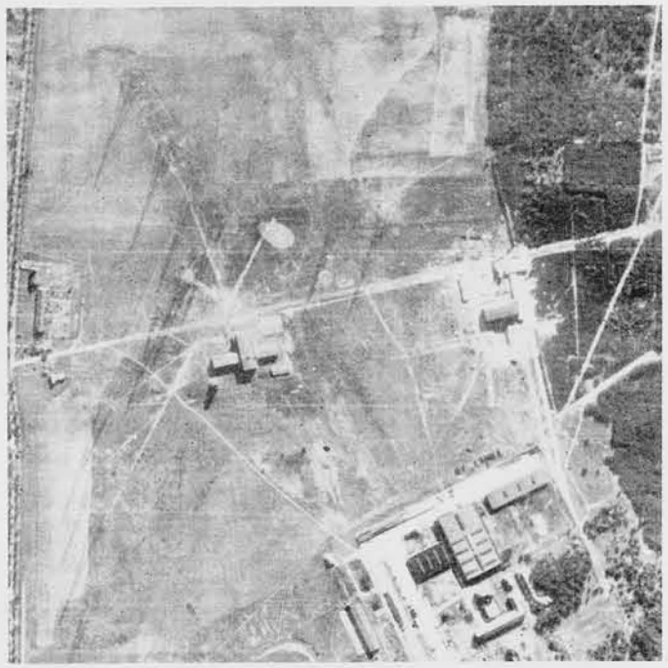


DECIMETER STATION

The above German Decimeter Station is near Le Havre, France. This equipment, widely used for German point to point communications, is Very High Frequency. The stations are spaced 30 miles apart and have masts 160 feet high.

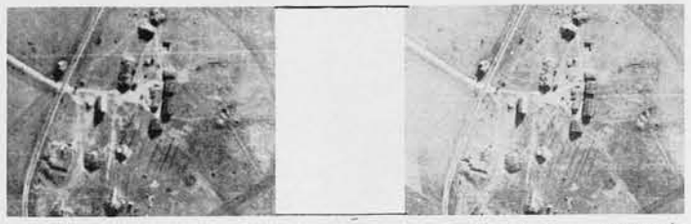


GERMAN



POWERFUL SHORT WAVE

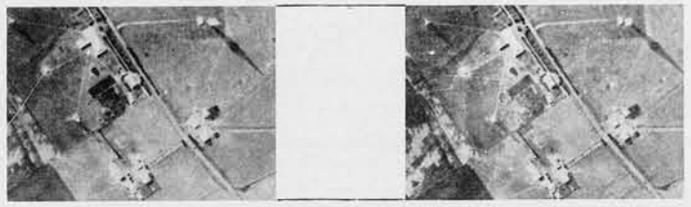
Giant short wave High Frequency transmitter, Zeesen. There are 10 masts 350 feet high. When high lattice masts are used in German radio, it is likely to indicate powerful High Frequency transmission. In Japanese-held territory, however, such masts would be likely to represent Low Frequency.



(R.F. - 1/9000±)

FIELD RADIO

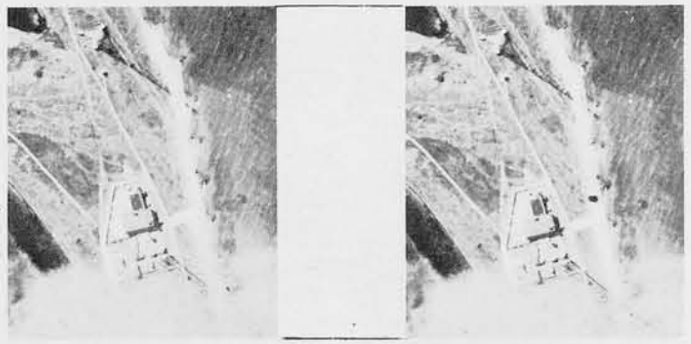
This German field radio station is similar to certain Japanese headquarters stations.



(R.F. - 1/10000±)

BROADCAST STATION

This station is a commercial station. Note German type lattice masts.

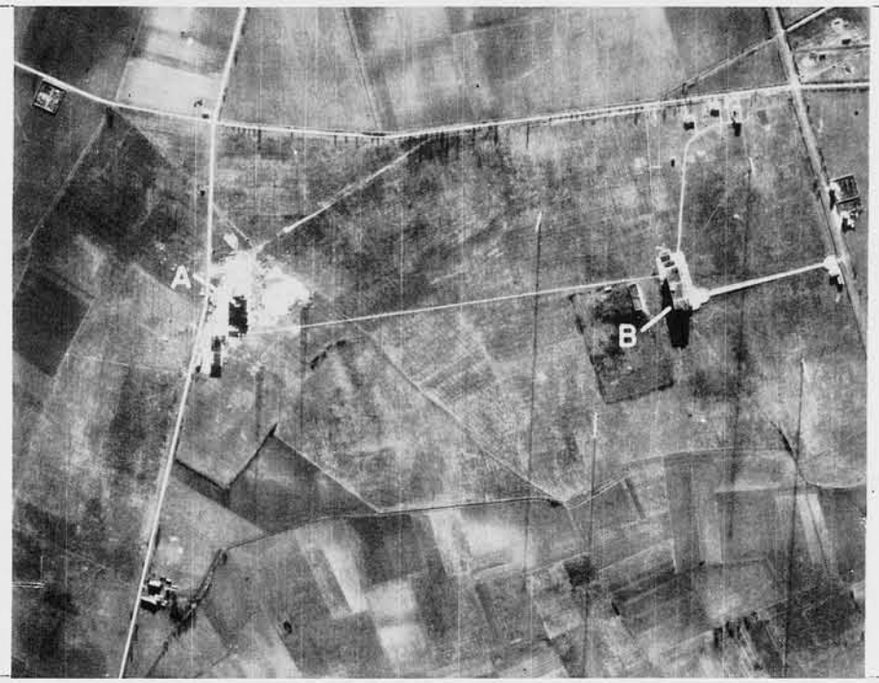


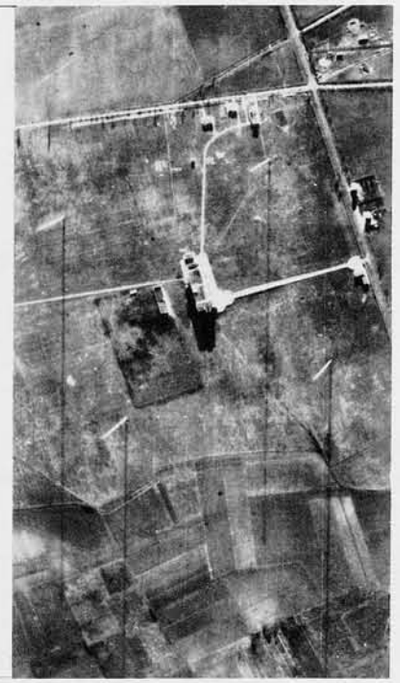
(R.F. - 1/2500 - no parallax)

DENMARK

These masts are approximately 350 feet high, spaced 250 feet apart, and indicate a powerful shortwave transmitter.

WEATHER STATION, SPITZBERGEN





BOURGES, FRANCE

Two very large stations under construction at Bourges.

Station "A" consists of 4 masts 800 feet high, insulated at base and guyed to concrete deadmen. The square pattern is ¼ mile on a side.

Station "B" consists of two lattice masts 350 feet high spaced 480 feet apart. Small stick masts, irregularly spaced, are present also, and may constitute an earth device.

These stations probably will operate on many different frequencies and will have great range. Station "A" is of French radio design; a similar type installation may be seen at Saigon, French Indo China.

VALHERMIEL, FRANCE

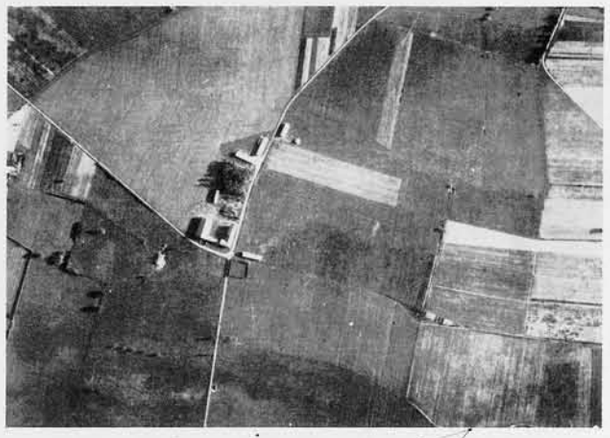
View of German type High Frequency masts with some stick masts of a directional Rhombic layout in the background. This station also has Medium Frequency masts (not shown).

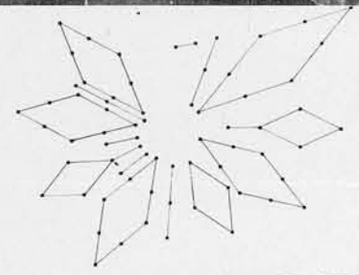
Antennae on High Frequency masts are probably in a vertical position.

(R.F. - 1/10000±)

GERMANY

Probable Medium Frequency Communication Station at an aircraft plant in Germany. The small square building probably contains the transmitter.





ROANNES CHANCEY, FRANCE

Directional Rhombic layout in France. This pattern may be used for highly directional transmitting and receiving of communications. It is a common Radio Intercept pattern.

SUPPLEMENTARY MATERIAL

SUPPLEMENTARY MATERIAL

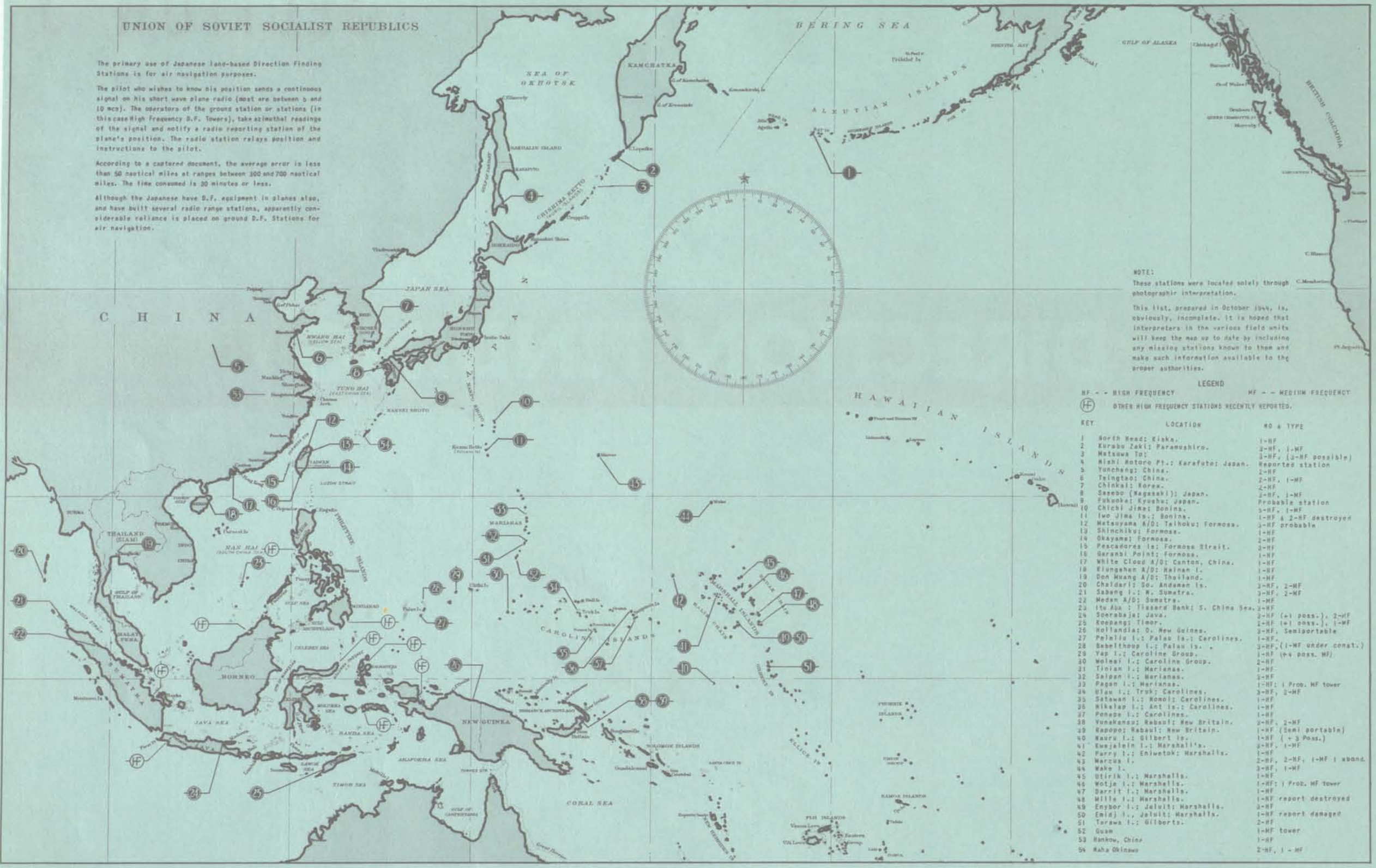
SUPPLEMENTARY MATERIAL

SECTION-3

3.01 — 3.99

DIRECTION FINDING

LOCATION OF JAPANESE DIRECTION FINDER STATIONS



The primary use of Japanese land-based Direction Finding Stations is for air navigation purposes.

The pilot who wishes to know his position sends a continuous signal on his short wave plane radio (most are between 6 and 10 mcs). The operators of the ground station or stations (in this case High Frequency D.F. Towers), take azimuthal readings of the signal and notify a radio reporting station of the plane's position. The radio station relays position and instructions to the pilot.

According to a captured document, the average error is less than 50 nautical miles at ranges between 300 and 700 nautical miles. The time consumed is 30 minutes or less.

Although the Japanese have D.F. equipment in planes also, and have built several radio range stations, apparently considerable reliance is placed on ground D.F. Stations for air navigation.

NOTE:
These stations were located solely through photographic interpretation.

This list, prepared in October 1944, is, obviously, incomplete. It is hoped that interpreters in the various field units will keep the map up to date by including any missing stations known to them and make such information available to the proper authorities.

LEGEND

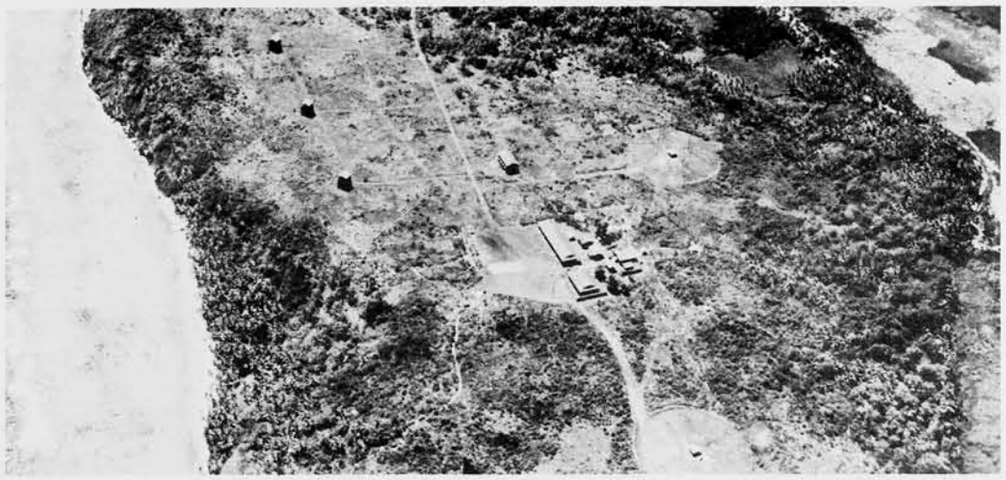
HF - - HIGH FREQUENCY MF - - MEDIUM FREQUENCY

(HF) OTHER HIGH FREQUENCY STATIONS RECENTLY REPORTED.

KEY	LOCATION	NO & TYPE
1	North Head; Kiska.	1-HF
2	Kurabu Zaki; Paramushiro.	2-HF, 1-MF
3	Matsuwa To;	2-HF, (2-HF possible)
4	Nishi Notoro Pt.; Karafuto; Japan.	Reported station
5	Yunchang; China.	2-HF
6	Tsingtao; China.	2-HF, 1-MF
7	Chinkai; Korea.	2-HF
8	Sasebo (Nagasaki); Japan.	2-HF, 1-MF
9	Fukuoka; Kyushu; Japan.	Probable station
10	Chichi Jima; Bonins.	2-HF, 1-MF
11	Iwo Jima Is.; Bonins.	1-HF & 2-HF destroyed
12	Matsuyama A/D; Taihoku; Formosa.	2-HF probable
13	Shinchiku; Formosa.	1-HF
14	Okayama; Formosa.	2-HF
15	Pescadores Is; Formosa Strait.	3-HF
16	Garansi Point; Formosa.	1-HF
17	White Cloud A/D; Canton, China.	1-HF
18	Klungshan A/D; Hainan I.	1-HF
19	Don Muang A/D; Thailand.	1-HF
20	Chalderi; So. Andaman Is.	2-HF, 2-MF
21	Sabang I.; N. Sumatra.	2-HF, 2-MF
22	Medan A/D; Sumatra.	1-MF
23	Itu Aba ; Tissard Bank; S. China Sea.	2-HF
24	Soerabaja; Java.	2-HF (+1 poss.); 2-MF
25	Koepang; Timor.	2-HF (+1 poss.); 1-MF
26	Hollandia; D. New Guinea.	2-HF, Semiportable
27	Paleliu I.; Palau Is.; Carolines.	1-HF,
28	Babelthoup I.; Palau Is.	2-HF,(1-MF under const.)
29	Yap I.; Caroline Group.	1-HF (+4 poss. MF)
30	Woleai I.; Caroline Group.	2-MF
31	Tinian I.; Marianas.	1-MF
32	Saipan I.; Marianas.	2-MF
33	Pagan I.; Marianas.	1-HF; 1 Prob. HF tower
34	Ulau I.; Truk; Carolines.	2-HF, 2-MF
35	Satawan I.; Nomoi; Carolines.	1-MF
36	Nikalap I.; Ant Is.; Carolines.	1-MF
37	Ponape I.; Carolines.	1-MF
38	Vunakanau; Rabaul; New Britain.	2-HF, 2-MF
39	Rapopo; Rabaul; New Britain.	1-HF (Semi portable)
40	Nauru I.; Gilbert Is.	1-HF (+ 3 Poss.)
41	Kwajalein I.; Marshall's.	2-HF, 1-MF
42	Parry I.; Eniwetok; Marshalls.	1-MF
43	Maroua I.	2-HF, 2-HF, 1-HF 1 xband.
44	Wake I.	2-HF, 1-MF
45	Utirik I.; Marshalls.	1-MF
46	Wotje I.; Marshalls.	1-HF; 1 Prob. HF tower
47	Darrit I.; Marshalls.	1-MF
48	Mille I.; Marshalls.	1-MF report destroyed
49	Enybor I.; Jaluit; Marshalls.	2-HF
50	Emidj I., Jaluit; Marshalls.	1-MF report damaged
51	Tarawa I.; Gilberts.	2-MF
52	Guam	1-MF tower
53	Hankow, China	1-MF
54	Naha Okinawa	2-HF, 1 - MF

DIRECTION FINDING
SUMMARY

Direction finders are RECEIVERS of radio signals. They are equipped to determine the direction from which such radio signals are being sent. D.F.ing is possible on any transmitting equipment operating in the same frequency band as the D.F. receiver.



D.F. STATION AT TRUK

D.F. installations are used on aircraft and on naval vessels as well as on land. This section, however, deals primarily with fixed land installations. D.F. is often used by the Japanese as an aid to aerial navigation in addition to its use for intelligence purposes. In such cases the customary procedure is as follows:

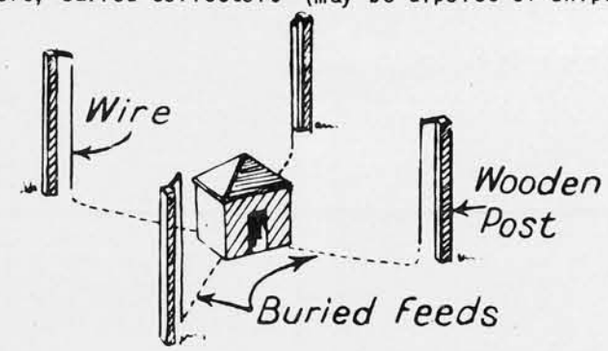
When Japanese pilots desire bearings from these stations, they hold down on the key sending a continuous signal on which an azimuth reading is taken by the D.F. operator. The bearing is then transmitted to the pilot via a radio communications station which is usually found near a D.F. installation.

TYPES OF D.F.

There are two basic types of direction finders - the loop and the Adcock. Although the loop method is used on aircraft and ships, the majority of Japanese land based D.F. stations photographed to date operate on the Adcock system.

ADCOCK

The Japanese style Adcock, in simplest form, may be described in this manner: Four vertical members arranged in a square, with the receiver in the center, and with diagonal electrical connections between the center and all four vertical members, called collectors (may be dipoles or unipoles).



This arrangement is augmented by a central sensing antennae (frequently not visible but which determines the direction of the signal after the line of bearing has been established.)

Example: When the unipoles determine the signal to be on 10^{o} - 190^{o} line the central sensing antennae indicates whether the signal is coming from 10^{o} or from 190^{o}.

This type may also be referred to as "fixed Adcock" in that the unipoles or dipoles do not rotate. It may be either completely housed or the collectors may be exposed.

As in Radio Communications, D.F. is catalogued by frequency. The common types are in the High and Medium frequency ranges.

TABLE OF FREQUENCIES

FREQUENCY	UNIPOLE OR (DIPOLE) DIAGONAL SPACING	UNIPOLE (OR DIPOLE) HEIGHT	WAVE LENGTH IN METERS	FREQUENCY IN MEGACYCLES PER SEC.
HIGH ("HOUSED ADCOCK")	20' TO 30' (MOST ARE 25')	15' TO 25'	100 TO 10 M	3 TO 30 MCS.
MEDIUM ("OPEN ADCOCK")	90' TO 150' (MOST ARE 100')	50' TO 75'	1000 TO 100 M	0.1 TO 3 MCS.

DIRECTION FINDING

SUMMARY (CONT.)

SPACING AND HEIGHT OF UNIPOLES

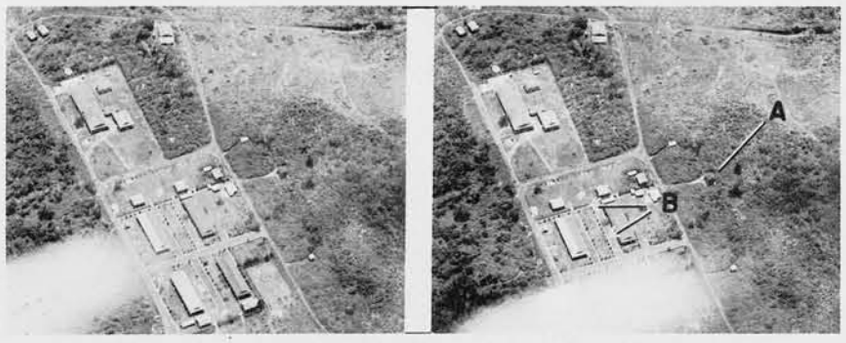
The frequency of Adcock type D. F. is determined by the photographic interpreter from the spacing and height of the collectors (unipoles or dipoles).

Rule of thumb method for determining wave length:

$$\text{Minimum wave length in meters} = \frac{\text{diagonal distance between collectors}}{0.2}$$

Translation to frequency:

$$\text{Frequency in Kilocycles} = \frac{300000}{\text{Wave length in meters}}$$



PONAPE, CAROLINES

Example of High Frequency D. F. with Radio Reporting Station nearby.

D. F. CENTERS

Many D. F. centers have easily recognizable "T", "H", or "L" shaped buildings which contain offices, communications, barracks, baths, messing facilities, power plant, storage etc.

The various elements are one story in height and are connected by narrow covered passageways.

DARRITT, MAJURO, MARSHALLS

General Notes on Japanese D. F.

1. Located near airfields (and other locations).
2. Site is well cleared, fairly level and high.
3. Pattern of roads and paths connecting installations, usually visible.
4. Radio communications station (reporting station) is always present or near at hand.
5. High and Medium frequency set-ups are usually present in combination at important D. F. centers.
6. A Japanese D. F. center usually consists of:
   - (a) high frequency installation, or
   - (b) two high frequency installations, or
   - * (c) three high frequency installations, or
   - (d) one medium frequency installation, or
   - * (e) two medium frequency installations, or
   - (f) combinations of high and medium frequency up to a usual maximum of three high and two medium.

* = most often found

NOTE: D. F. stations at Chichi Jima and at Matsuwa have 6 H. F. Towers. These cases, however, are exceptional and were the result of additions to the original stations.

DUPLICATION OF INSTALLATIONS

The Japanese frequently build duplicate installations of the same frequency on the same site. The building arrangement is considered as having no particular electrical significance.

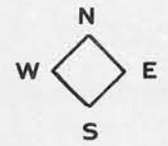
Probable reasons:

1. To operate at slightly different frequencies at the same time within a given frequency range.
2. For security reasons - in the event of damage or breakdown of equipment.
3. When spread out over long distances they may be used to locate objective by triangulation.

ORIENTATION

The preferred method of orientation is as follows:

Open Adcock



Housed Adcock

Ordinarily, D. F. installations are constructed with a definite relationship to North. The sides of all buildings usually fall in a constant relation to North and therefore, are parallel to each other.

It is an advantage, when constructing D. F. stations, to establish and incorporate the direction of North into the construction of collectors at an early stage. Thus, when the layout is installed, the calibrations for azimuth readings are easily related to a fixed reference line.

HIGH FREQUENCY ADCOCK

The Japanese usually construct the high frequency Adcock in a house which encloses the dipoles within its walls, one set of dipoles being in each corner.

This installation which is called "Housed Adcock" has been standardized to some extent in use throughout the Pacific Islands.

PATTERNS

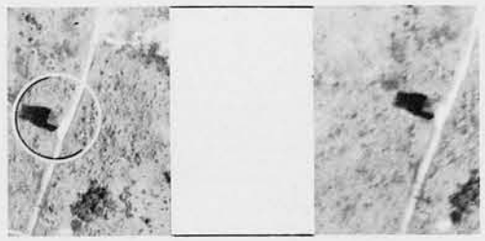
Although found in ones, twos, and threes, most stations have three Housed Adcocks arranged in a triangle or on a straight line. Arrangements vary to such an extent that identification cannot be based on pattern.

The type most often found is identified best by the following key dimensions:
Plan view - 23' x23' (including roof overhang). Interior - 20' x20'.
Height - 32' (from ground to eave)
Buttresses - 5' spread at base

* (Note: Hereafter, this type of station will be called a "Housed Adcock" or "High Frequency D. F. tower".)

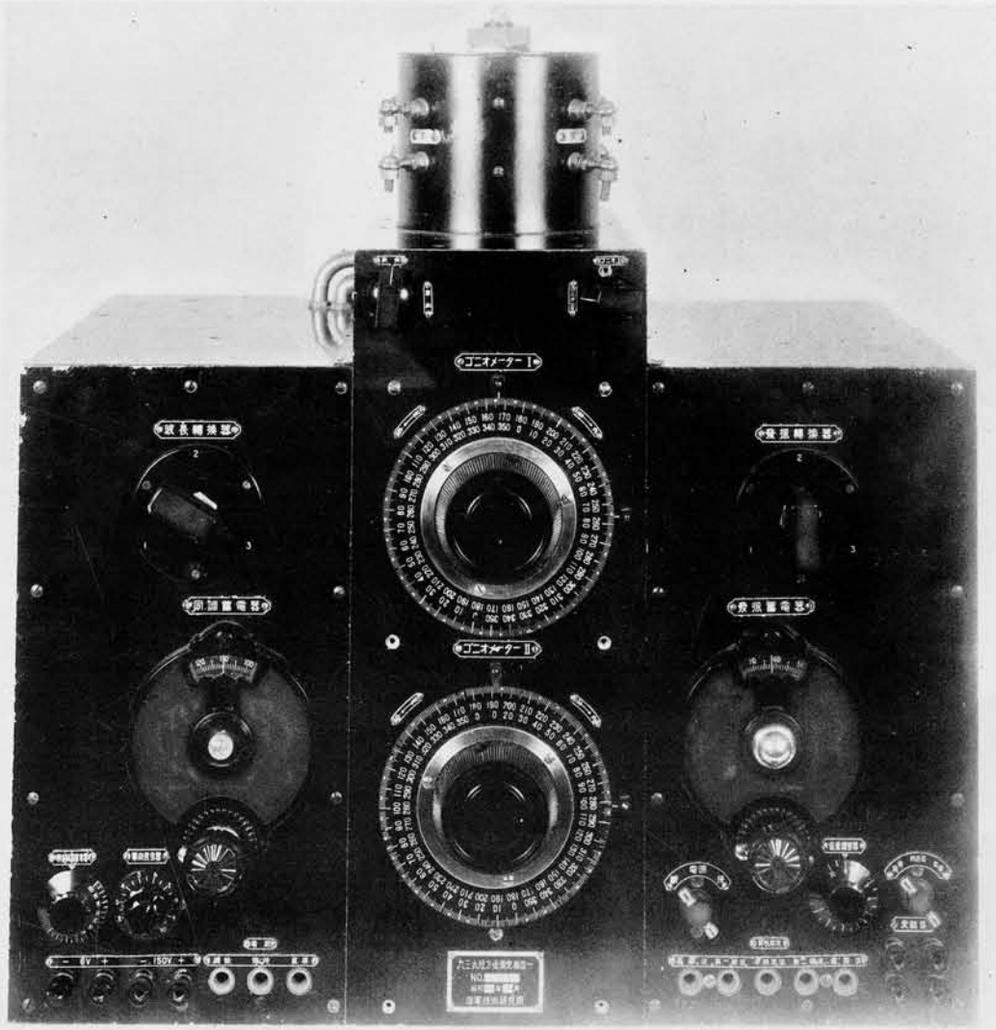
RIGHT: Front view of High Frequency D. F. Receiver. Connections with dipoles are made at the top of instrument which is surmounted by the central sensing antennae. Goniometers are used to determine direction instead of rotating the dipoles which are fixed in the corners of the building.

BELOW: High Frequency D. F. tower at Kwajalein. The receiver, dipoles, and operator's table are all enclosed within the walls of this structure. The buttresses, for some unknown reason, are usually present on D. F. towers.



KWAJALEIN

KWAJALEIN



JAPANESE HIGH FREQUENCY D. F. RECEIVER

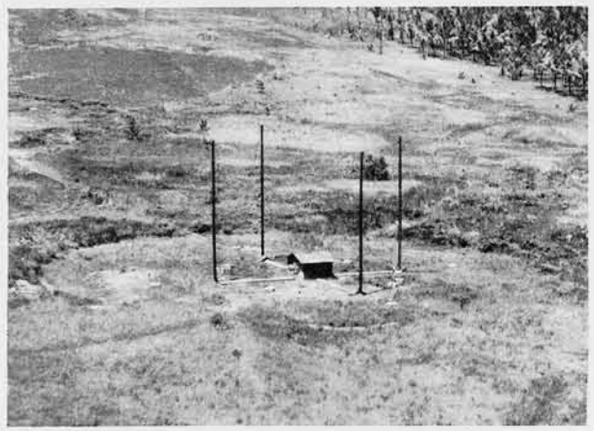
MEDIUM FREQUENCY ADCOCK

Most Japanese Medium Frequency Adcock D. F. stations ("Open Adcock") may be identified by the following keys:

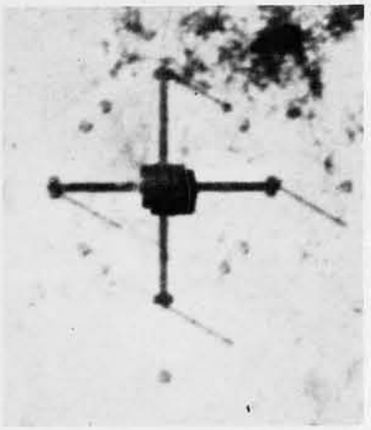
1. Four stick masts (unipoles) arranged in a square pattern.
2. Small hut in center approximately 20 feet square.
3. Strongly visible diagonal lines (cables) connecting unipoles.
4. Diagonal distance between unipoles is approximately 100 feet.
5. 12 Square concrete blocks 3' x3' anchoring guy wires.

The Medium Frequency Adcock operates in a similar manner to the High Frequency, the main difference being the greater distance between vertical antennae elements which is necessary for efficient medium frequency reception.

The four stick masts found with this installation are called unipoles, electrical connections being made by means of buried feeds leading from each pole to the central hut or shack.



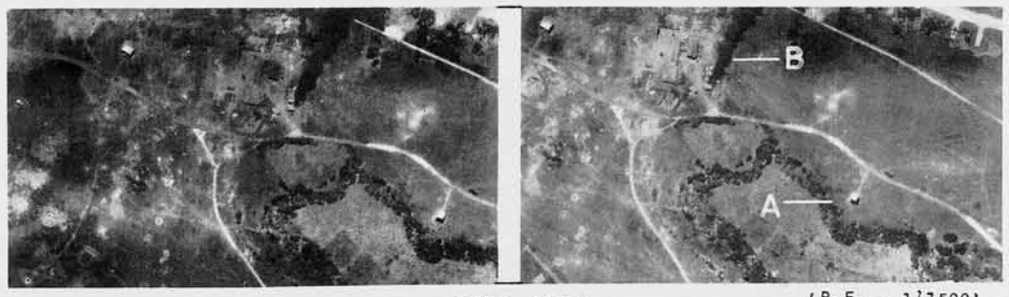
VUNAKANAU, RABAUL, NEW BRITAIN



WAKE

DIRECTION FINDING
SUMMARY (CONT.)

IWO JIMA



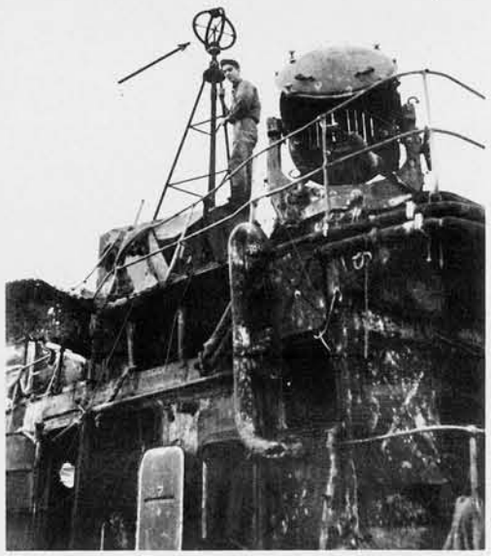
IWO JIMA (R.F. - 1/7500)

"A" - TYPE I HIGH FREQUENCY D.F. TOWER
"B" - D.F. CENTER WITH MEDIUM FREQUENCY RADIO REPORTING STATION

BELOW, LEFT: Two Direction Finding towers at Pagan. The height of the left tower is 32 feet (from ground to eave) while the right tower is about 22 feet high. The short tower design is not used to a great extent, and is thought to house a Naval type Medium Frequency loop D.F. equipment.

BELOW, RIGHT: Medium Frequency loop type D.F. antennae used on Japanese naval vessels.

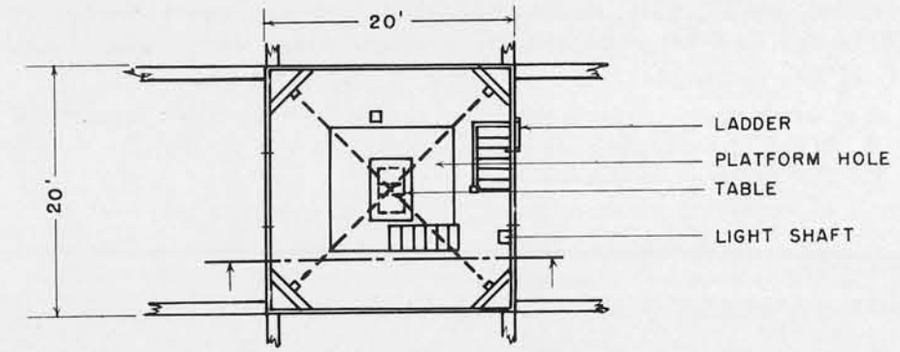
PAGAN, MARIANAS

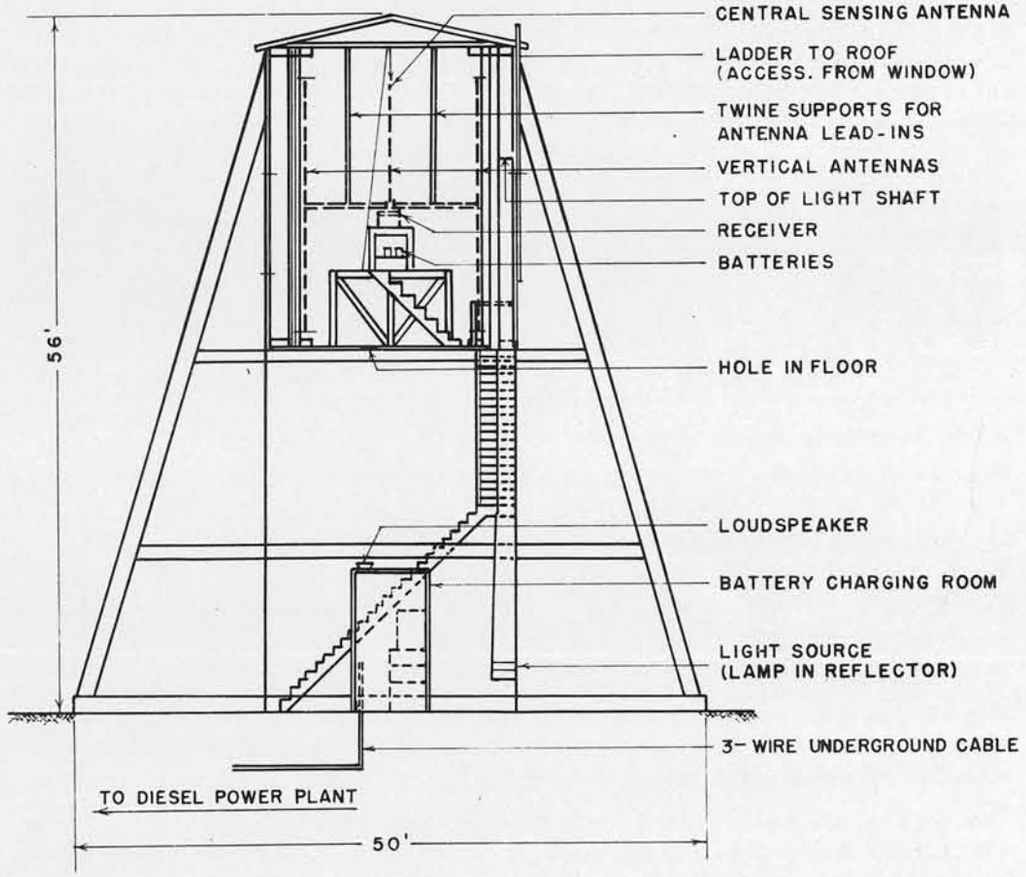


DIRECTION FINDER ON D.D.

BELOW: The drawing below was made from a High Frequency D.F. tower at Tarawa. It is not a typical design in that it is higher than any others seen to date. However, it is thought that the basic principles of the interior design are characteristic of most Japanese High Frequency D.F. towers.

As can be seen from this diagram, each D.F. tower requires an operator.

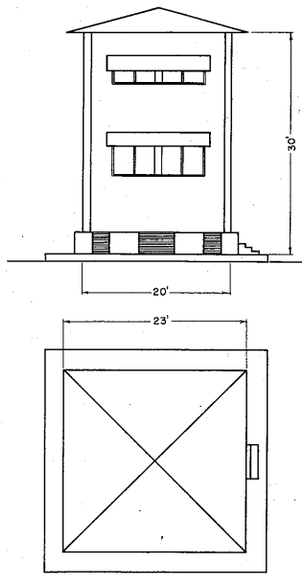




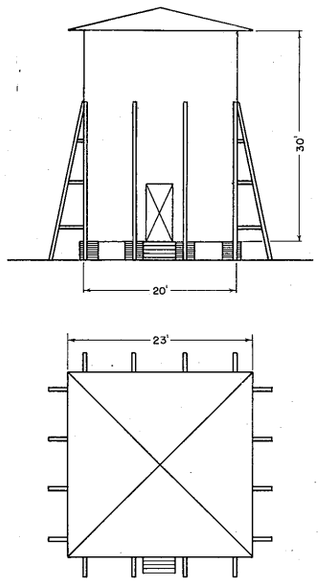
CONFIDENTIAL

DIRECTION FINDING

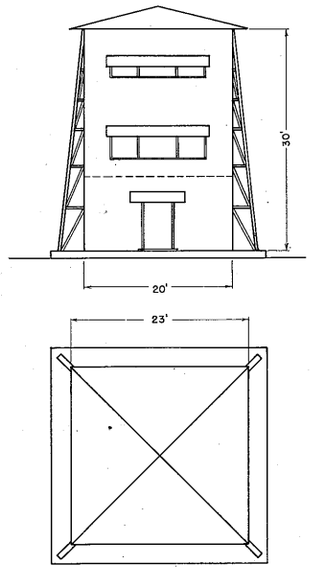
SUMMARY (CONT.)



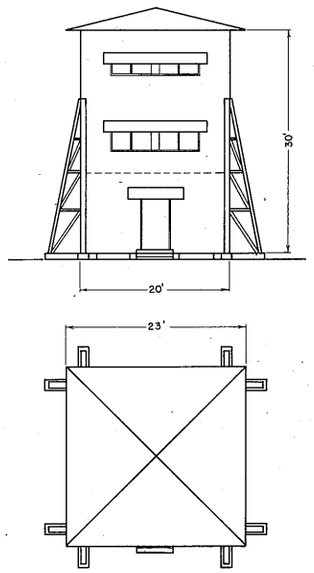
TYPE 1



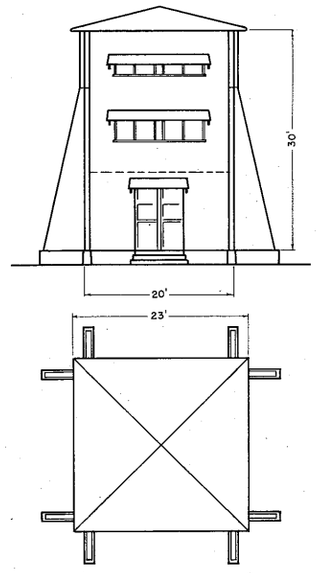
TYPE 2



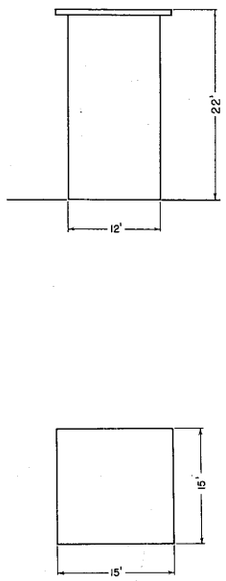
TYPE 3



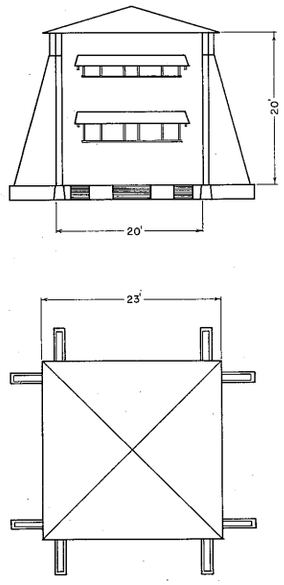
TYPE 4



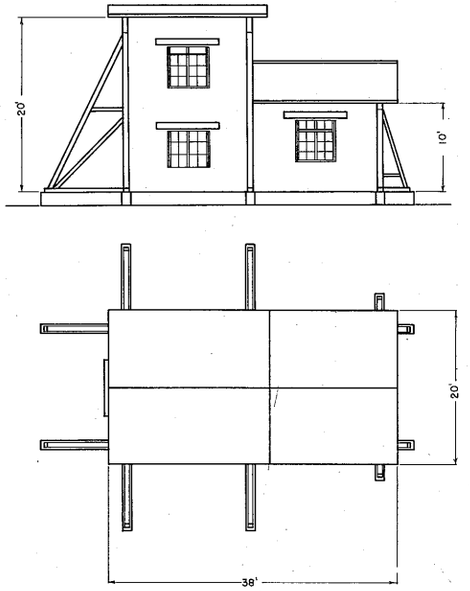
TYPE 5



TYPE 6



TYPE 7



TYPE 8

On this page are shown eight D. F. tower designs in use by the Japanese. Types "1", "2", "3", "4", and "5" are thought to enclose High Frequency Adcocks. These structures are 20' square by 30'-32' high.

Types "6", "7", and "8" are thought to enclose Medium Frequency rotating loop D. F. (similar to naval type). The loop type may be used in a structure with a floor plan of less area than High Frequency fixed Adcock. A 12 foot square plan would allow sufficient space. The best clue, however is in the height of the structure. 18-20 feet of height is sufficient for a loop type, but is not considered enough for a High Frequency fixed Adcock.

Elaborate buttress systems characterize many of these designs. The towers are capable of withstanding abnormally high winds.

The towers shown were reconstructed from aerial photographs and not to be regarded as examples of detailed accuracy - but merely key information for identification purposes.

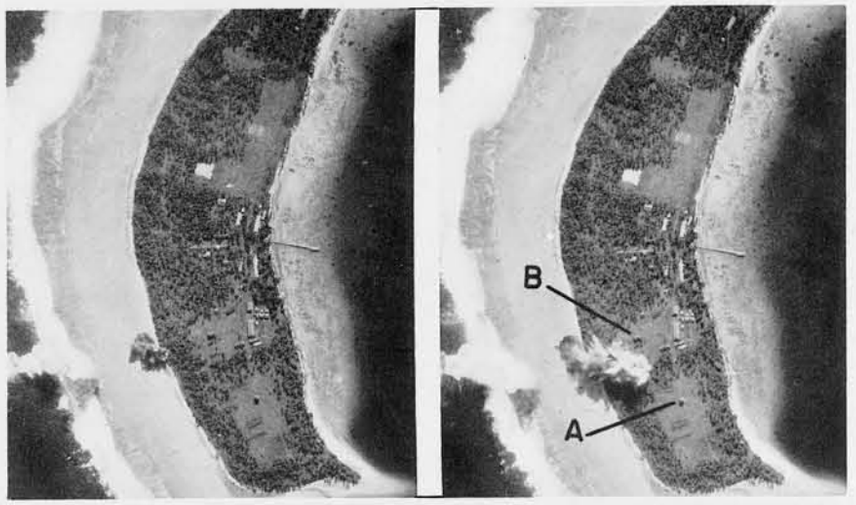
[redacted]

DIRECTION FINDING
HIGH FREQUENCY

MAJURO

This D.F. set up, when captured on Darritt Island, Majuro, had been abandoned before equipment was installed in the buildings. However, due to the fact that no damage resulted from the occupation, these provide a good opportunity for studying the architectural details of the most recent D.F. building design. Note the finished appearance of the Structures, in which even the buttresses are sheathed with clapboards. This is type "5".

MAJURO

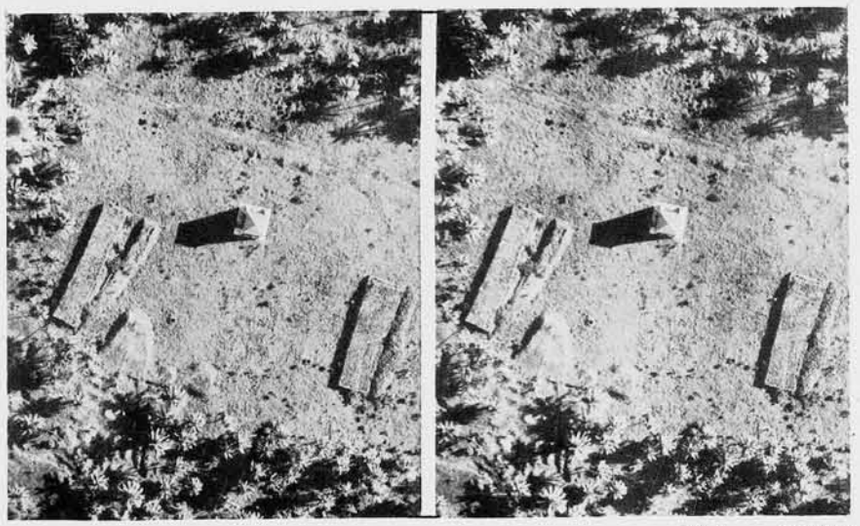


(R.F. - 1/17000)

MAJURO

Above: "A" = High Frequency D.F., "B" - Probable Generator Building

Below are close ups of the two structures erected on Darritt. The one at the left was designed to house the High Frequency D.F. equipment. The building at the right is a standard type, seen usually with large D.F. centers and is thought to be a generator building. However, it may contain a D.F. receiver. This, however, has not been determined from ground information as yet. Approximate dimensions are length -38', width 32', height 22'.



(R.F. - 1/2200)

MAJURO

The above Stereogram shows quite clearly the important identification characteristics of the High Frequency D.F. tower. The hipped roof is 23' to 24' square (including overhang). Height, from ground to eave is 32'. The buttresses, spreading 6' at the base are clearly visible here.

MAJURO
High Frequency D.F. tower
Note that there is but one floor above the ground floor.

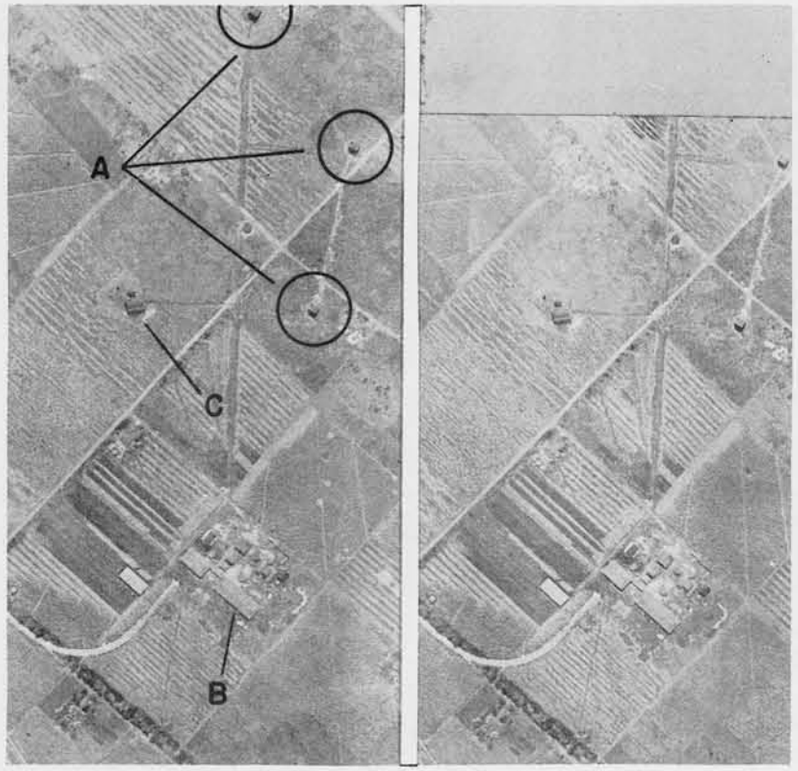
MAJURO
Unidentified. Probable Generator Building
This structure was empty when our troops took over Majuro.

CONFIDENTIAL

DIRECTION FINDING
HIGH FREQUENCY (CONT.)

JALUIT, MARSHALLS

Type "5" similar to Majuro tower but without window sun shades. Roof is hipped and measures 23' x 23' in plan, including overhang.

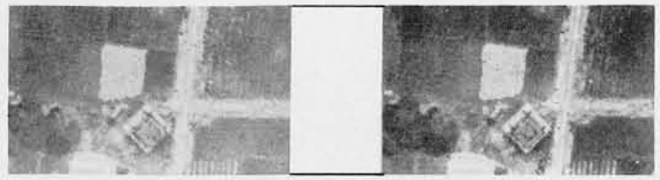


(R.F. - 1/6000)

SAIPAN, MARIANAS

"A" - High Frequency D.F.
"B" - D.F. Center
"C" - Probable Generator Building

A High Frequency D.F. Station on Saipan. Complete with D.F. center and large (probable) generator building. It is more usual to find one or two Medium Frequency installations, in addition to the High Frequency towers, with this size station. Contents of "C" have not been reported as yet.



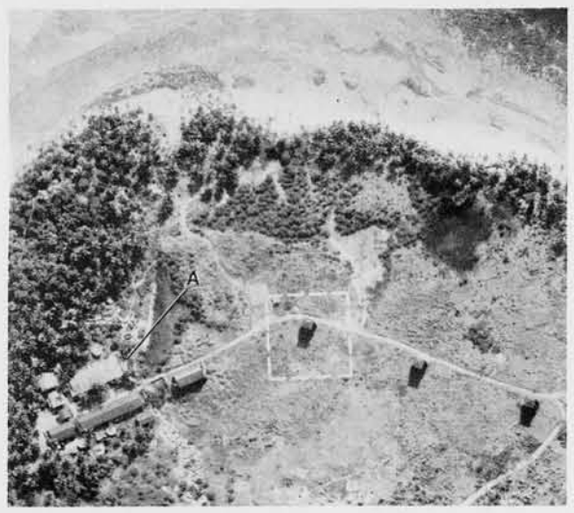
(R.F. - 1/2200)

TINIAN, MARIANAS

Type "4" tower with hipped roof and wooden sun shades. The pattern on the roof presents an unusual appearance in this view.

VUNAKANAU, RABAUL

Type "4" High Frequency D.F. tower with hipped roof at Rabaul. This is one of three which are used.



(R.F. - 1/3500)

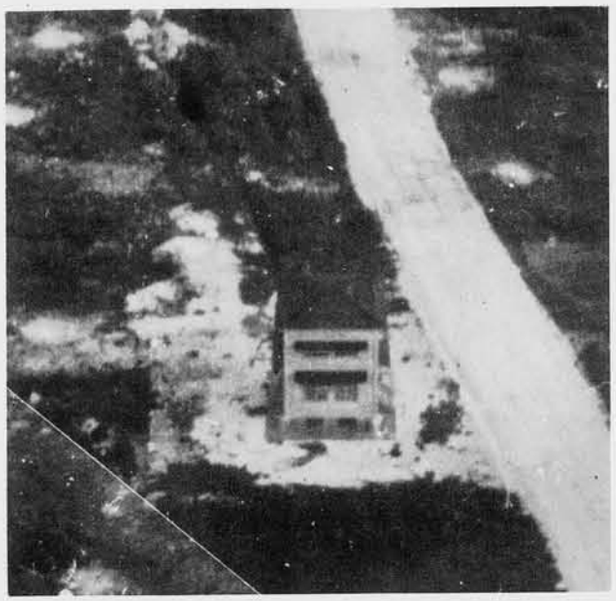
JALUIT, MARSHALLS

Vertical view of all three towers in the Jaluit Direction Finding Station. Note the "in line" pattern, road connection to all towers and probable generator building at left.

ULALU, TRUK

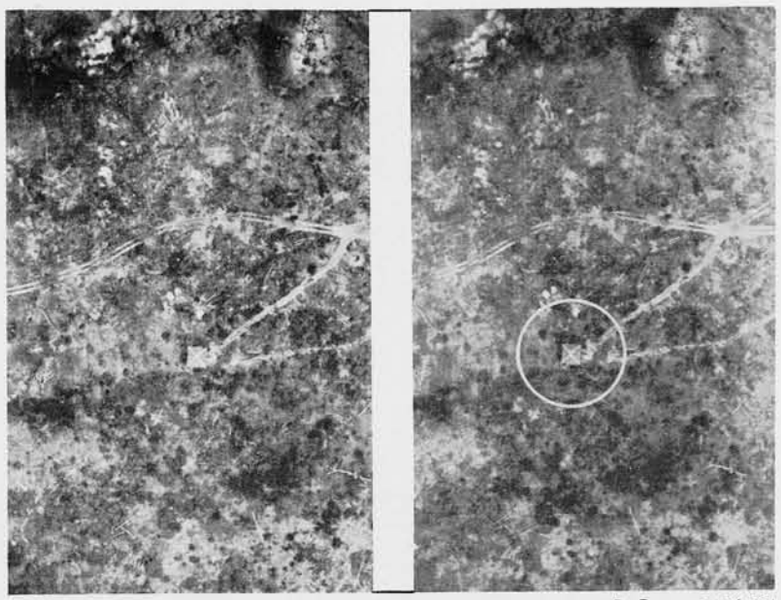
Type "4" tower with pitched roof and wooden sun shades. Note that road or path is always visible at operative stations.

DIRECTION FINDING
HIGH FREQUENCY (CONT.)



WAKE

Tower on Wake, Type "I", was one of the earliest examples found of Japanese High Frequency D.F. towers. Note the absence of buttresses.



(R.F. - 1/2600)

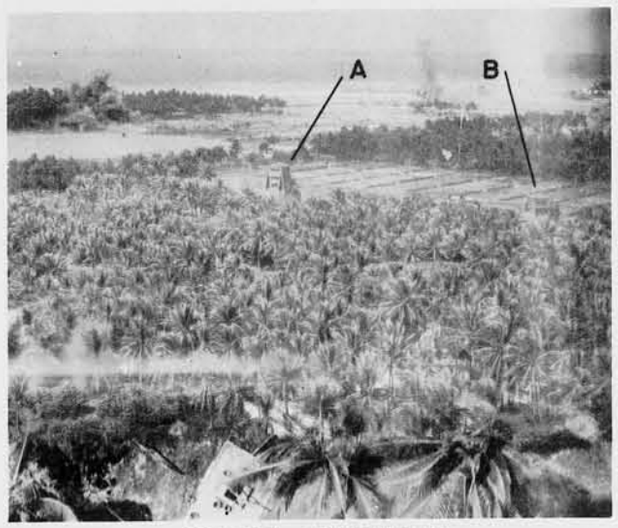
MILLE, MARSHALLS

This installation at Mille is unusual in construction. The four rows of buttress type braced on each side have not been seen elsewhere. Apparently, construction was not complete when these pictures were taken.

(R.F. - 1/4700)

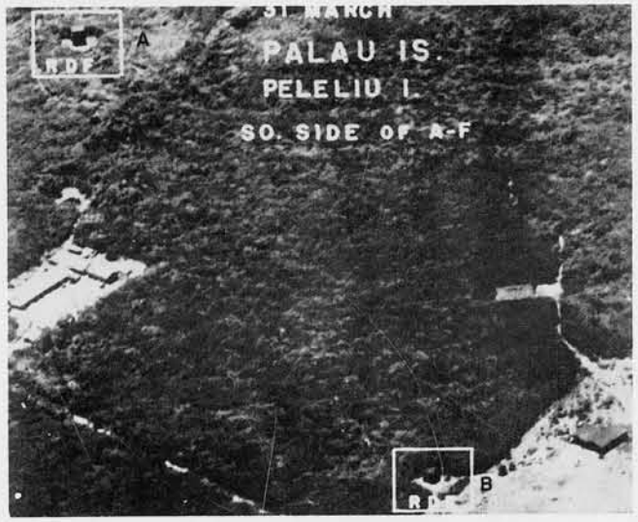
ITUABA, TISSARD BANK

It is difficult to determine the exact design of these towers due to the unusual shadow pattern. This equilateral triangle pattern is often found. Distance between towers is 350'.



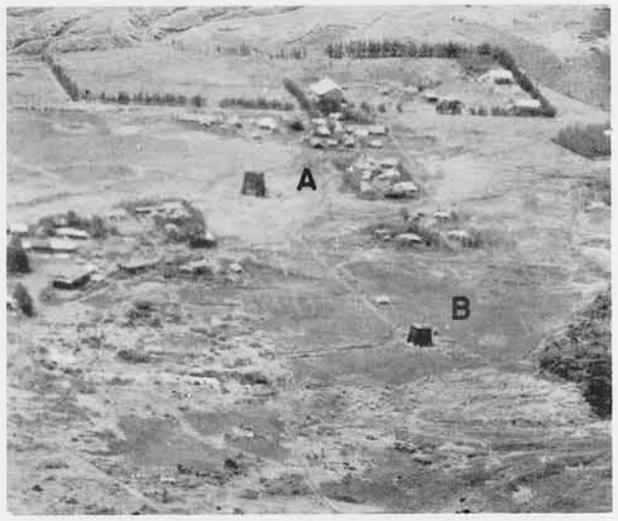
WOTJE, GILBERTS

"A" - High Frequency D.F. tower
"B"-Probable Medium Frequency tower (loop type)



PALAU

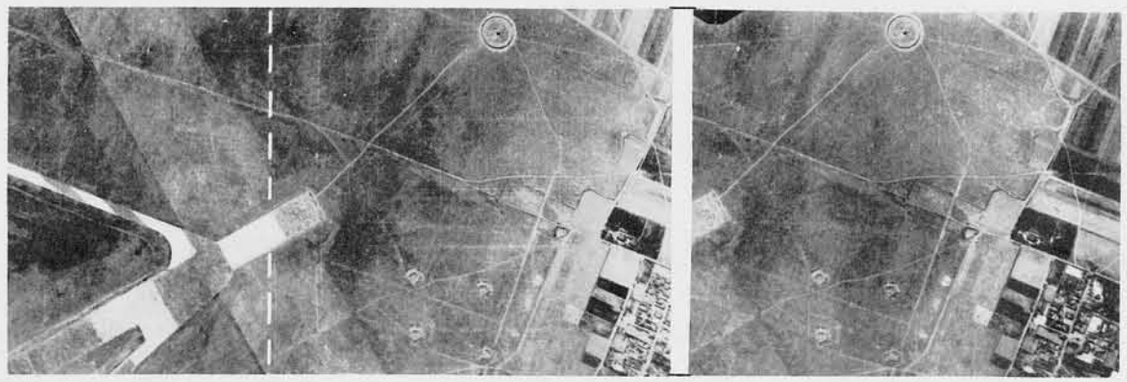
"A" - High Frequency D.F. tower
"B"-Probable Medium Frequency tower (loop type)



PAGAN, MARIANAS

"A" - High Frequency D.F. tower
"B" Probable Medium Frequency tower (loop type)

These examples, at Wotje, Palau, and Pagan, illustrate a lower design of tower which is occasionally found with the 32' high standard tower. These low towers are approximately 22 feet high, from ground to roof eave, and probably enclose Medium Frequency loop type D.F. apparatus operating best between 100 and 2000 Kcs.



YUNCHENG, CHINA (R.F. - 1/13000)

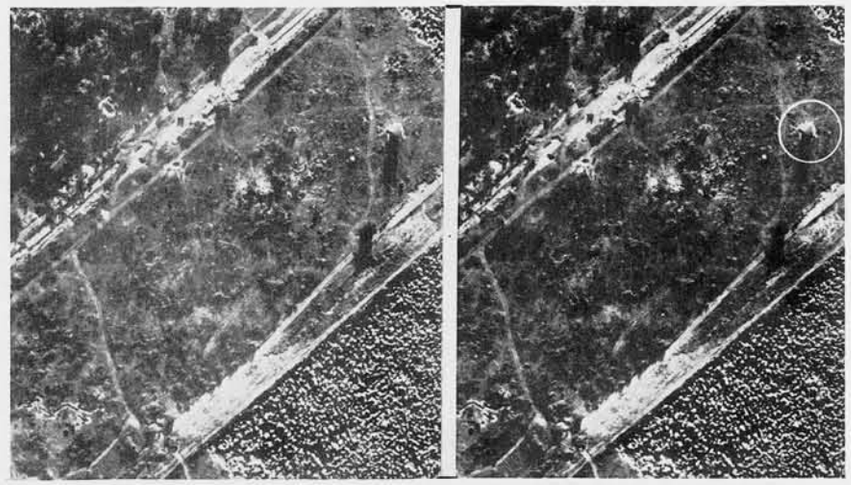
The installation shown above appears, at first glance, to resemble a fuel storage tank emplacement. However, upon closer examination, it is found to be a structure which resembles a typical D.F. tower, surrounded by a dike for protection against flood water.

HANKOW, CHINA (R.F. - 1/13000)

Probable High Frequency D.F. tower set in a square enclosure which appears to be a protective dike.

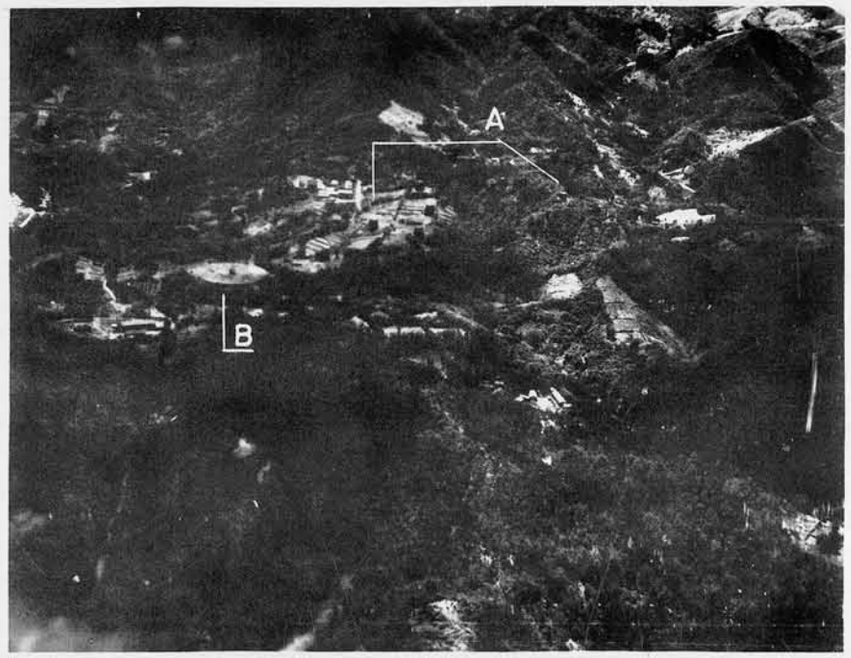
"A" - End of runway.

"B" - Unidentified tower, possibly High or Very High Frequency D.F.



NAURU (R.F. - 1/5000)

Type "3" D.F. tower. Note single corner buttresses.



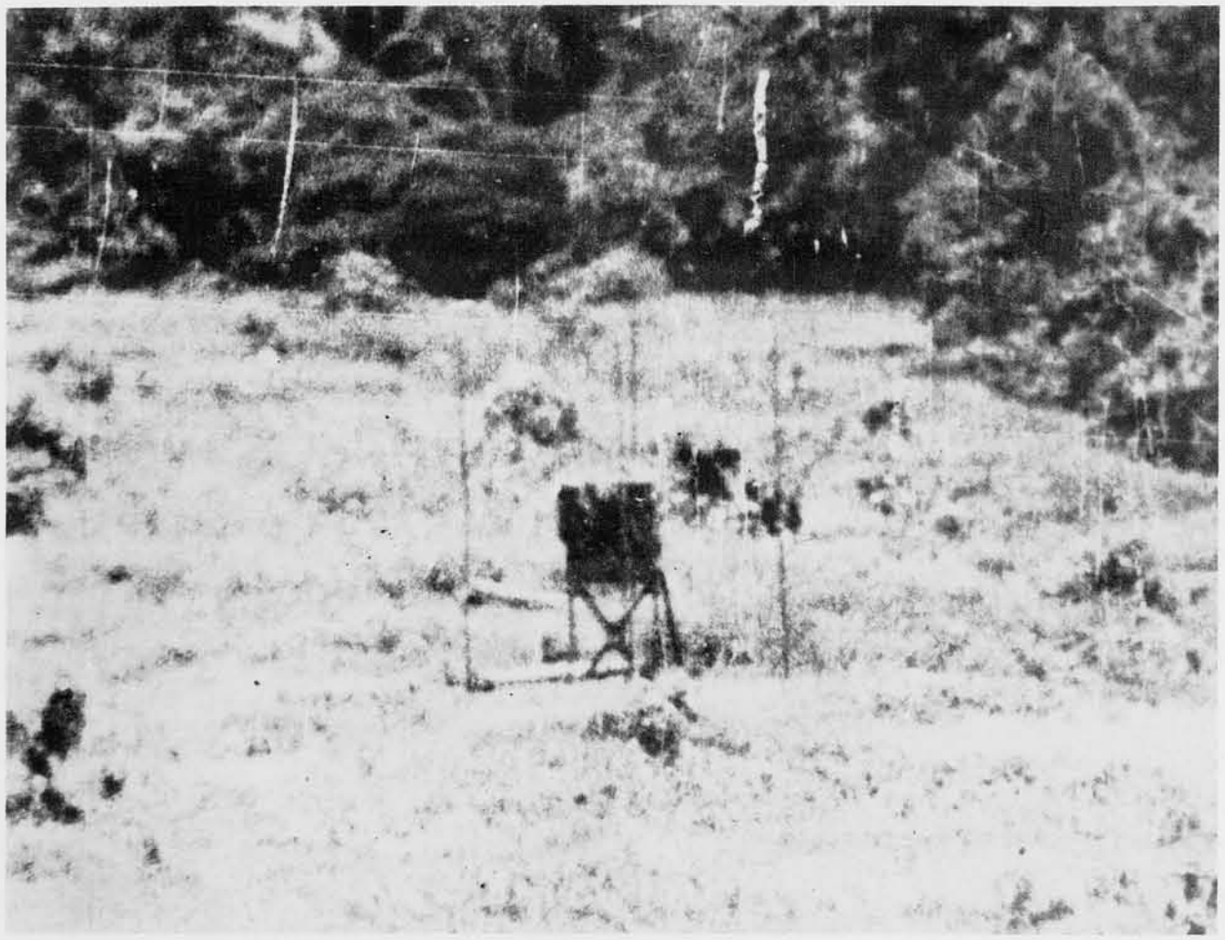
CHICHI JIMA, BONIN IS.

"A" - Six high frequency D.F. towers

"B" - One Medium Frequency D.F.

This is one of the very few examples of a group of more than three D.F. towers on the same site. Normally, if more than three towers are used on an airfield, they are widely separated.

DIRECTION FINDING
HIGH FREQUENCY (CONT.)



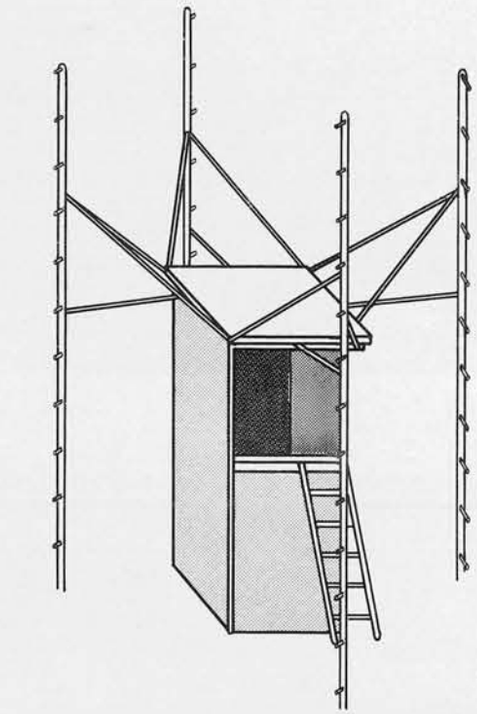
RAPOPO, NEW BRITAIN

This installation, observed at Rapopo and at Hollandia, is apparently a semi-portable type of High Frequency D.F. in the upper part of the High Frequency band.

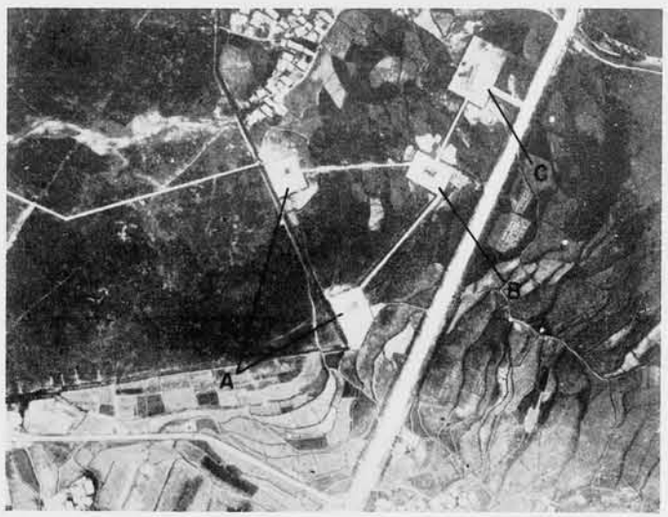
The diagonal distance between poles is approximately 18 feet. Poles are 25 feet high. These are very difficult to pick up at small scale photography, the operator's tower being only 7 or 8 feet square in the plan view.

This structure is probably not a standard new type but a portable adaptation of the Mark I, Model 2 D.F. receiver as used in the "Housed Adcocks".

RIGHT: At Hollandia, three of these installations were used near the airfield in an irregular pattern, spaced a few hundred feet apart.



HOLLANDIA, NEW GUINEA

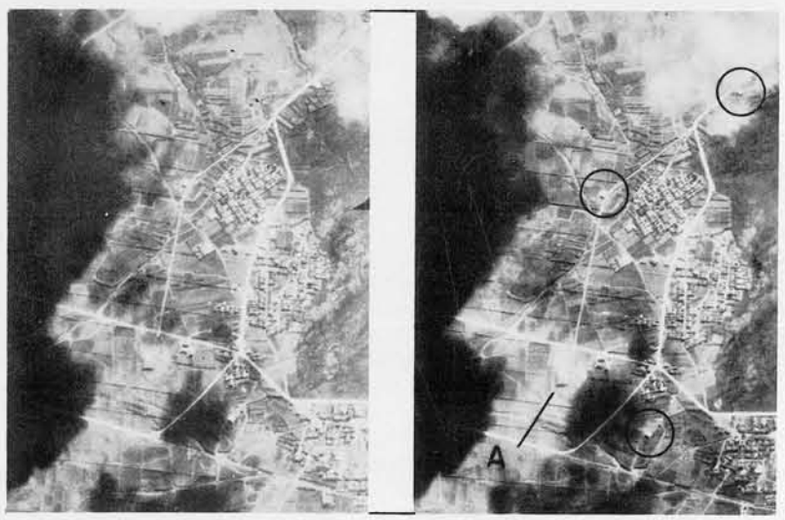


CHINKAI, KOREA (R.F. - 1/6000)

This station in Korea contains (A) 2 High Frequency towers, (B) probable generator building, (C) D.F. center. The distance between towers is about 500'.

Patterns of arrangement may assume many different forms. However, road connections to the towers and cleared areas near the instrument create unmistakable patterns.

RIGHT: The D.F. center ("A") with this installation appears to be partially buried. The High Frequency towers are 1200' and 1800' apart.



PESCADORES IS. (R.F. - 1/16250)

DIRECTION FINDING
MEDIUM FREQUENCY

The Japanese Medium Frequency (0.1 to 3 mcs.) Adcock type Direction Finder is shown on these and the following pages. It is designed for receiving and locating Medium Frequency transmitters.

Diagonal distance between unipoles	100'
Height of unipoles	60'-70'
Plan size of central shack	20' x20'
Height of central shack (ground to eave)	8'
Plan size of concrete anchors (12 in no.)	3' x3'
Average diameter of circular clearing	250'

This view shows clearly the Receiver Shack, covered cable connections, guy wires, and concrete anchors. The cable connections and concrete blocks are good recognition features at scales of 1/15000 and over, in cases where the poles are not readily seen.

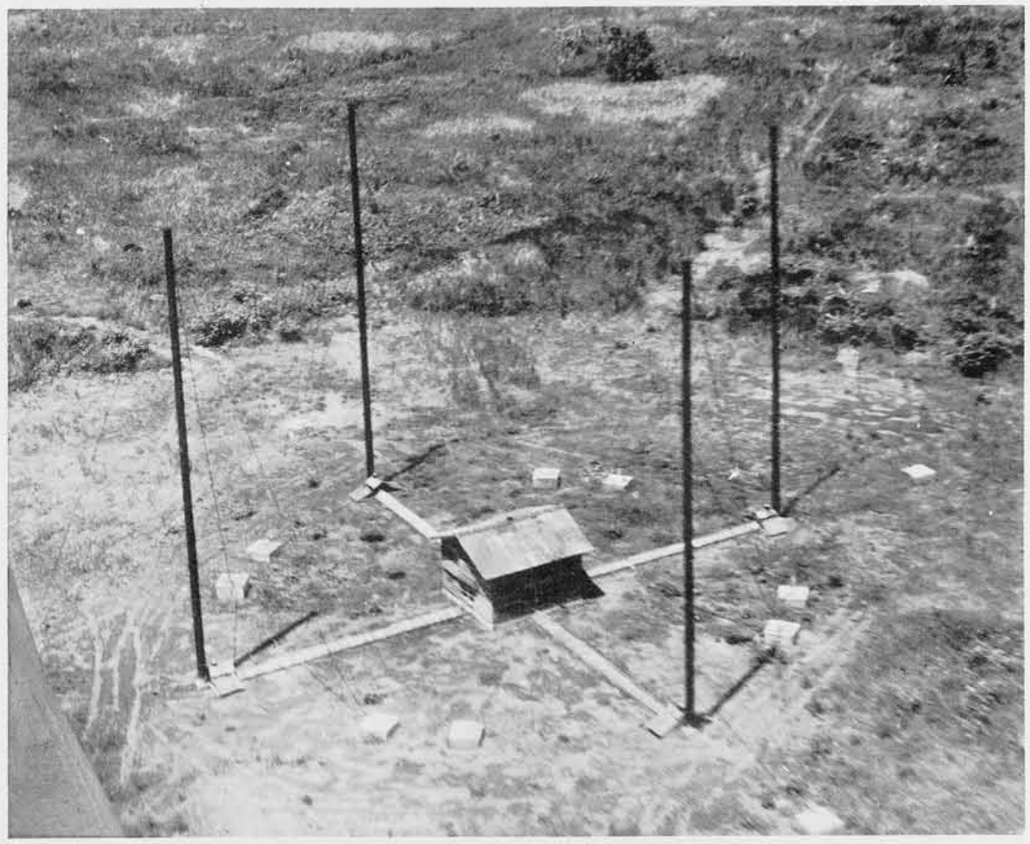
When a Medium Frequency D.F. is found, it will usually be accompanied by High Frequency towers. However, the reverse is not true, in that High Frequency towers are often found alone.

Recently, a rotating loop type D.F., such as is found on naval vessels (see page 3.04), has been discovered in use as a Medium Frequency land installation.

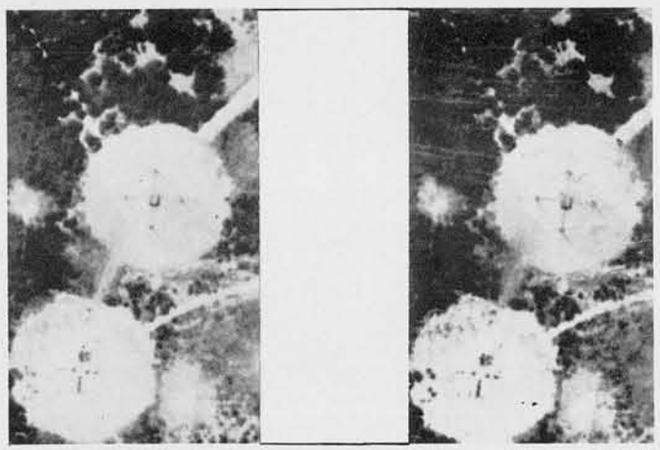
In this instance, the naval type loop was fitted into a wooden tower, resembling the standard Japanese High Frequency towers, but smaller. Tower was 12 feet square and 18 feet high.

The loops are slightly less than 3 feet in diameter and connected to a metal shaft leading down to the operator's table, 13 feet below the loop.

It is thought that this installation can D.F. on frequencies between 100 KCS and 2000 KCS, but is less efficient than the fixed Adcock type shown on this page.

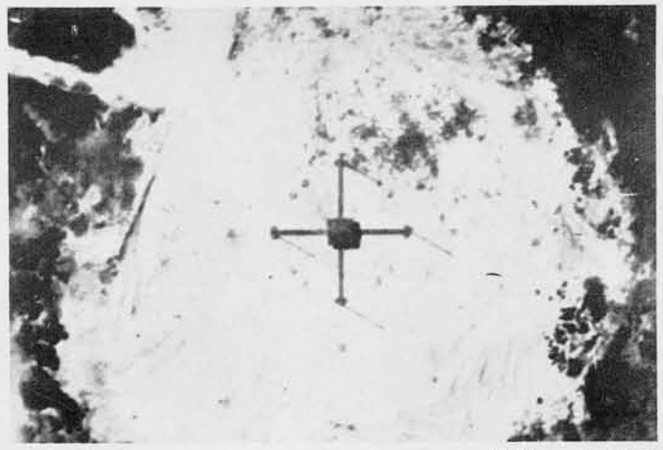


VUNAKANAU, RABAUL, NEW BRITAIN



MARCUS (R.F. - 1/3600)

Medium Frequency equipment is often found as twin installations. This setup at Marcus shows two unmistakable circular clearings of 250' diameter which characterize the Japanese Medium Frequency Adcock.



WAKE (R.F. - 1/1800)

Note that the covered cable connections, in this case, photograph dark in tone. Pattern is made up of crossing cable lines, central shack, concrete anchors, poles and clearing (usually circular).

VUNAKANAU, RABAUL, NEW BRITAIN

View showing both of the medium frequency D.F. installations at the Vunakanau Airfield. Three high frequency towers (not shown here) are also present at this station.

DIRECTION FINDER
MEDIUM FREQUENCY (CONT.)

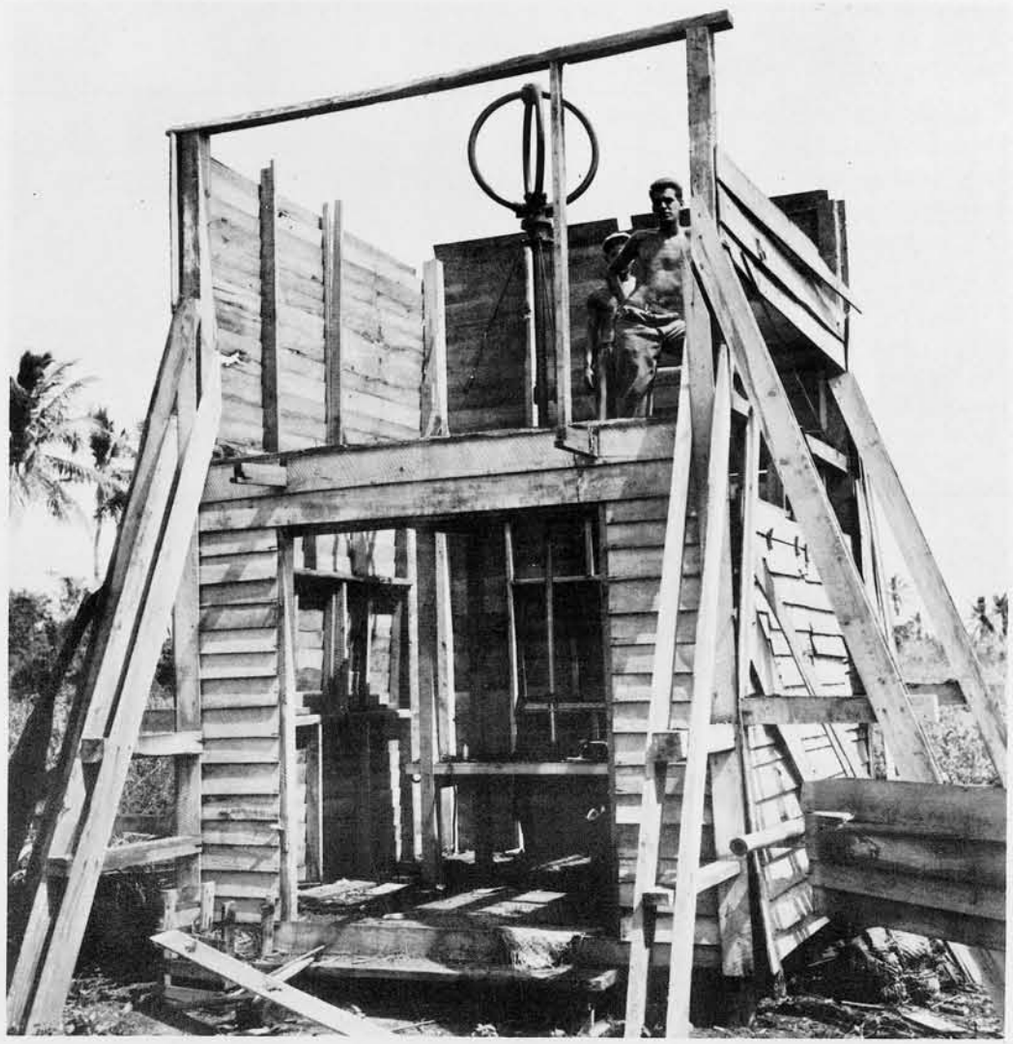
Medium Frequency D.F. tower at Guam. Rotating loop, diameter 3 feet, is similar to type used on naval vessels.

The 12 foot vertical shaft is of metal and its base is set on the operators table. The distance from the floor of the building to the top of the loop is 17 or 18 feet.

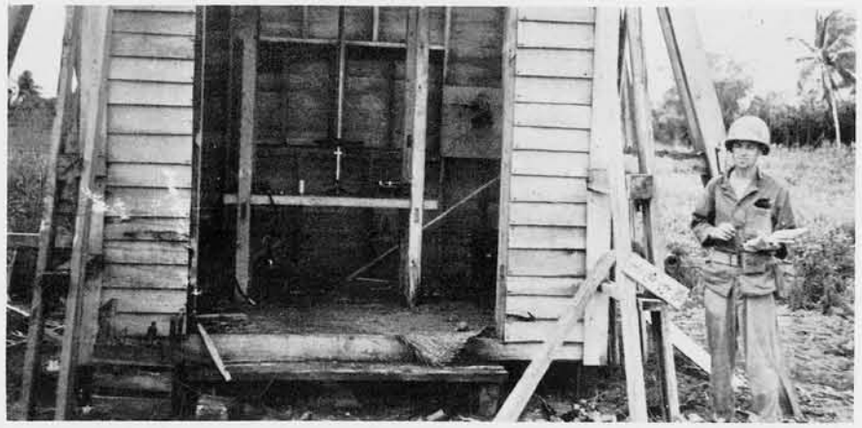
The building is 11'-12' square in plan view (minus buttresses) and was erected in a cleared area.

This building is very apt to be confused with the better known High Frequency D.F. tower, or "Housed Adcock". This type D.F. does not operate on the Adcock principle, however, and its loop is very probably constructed for receiving Medium Frequency signals.

M.F. LOOP TOWER



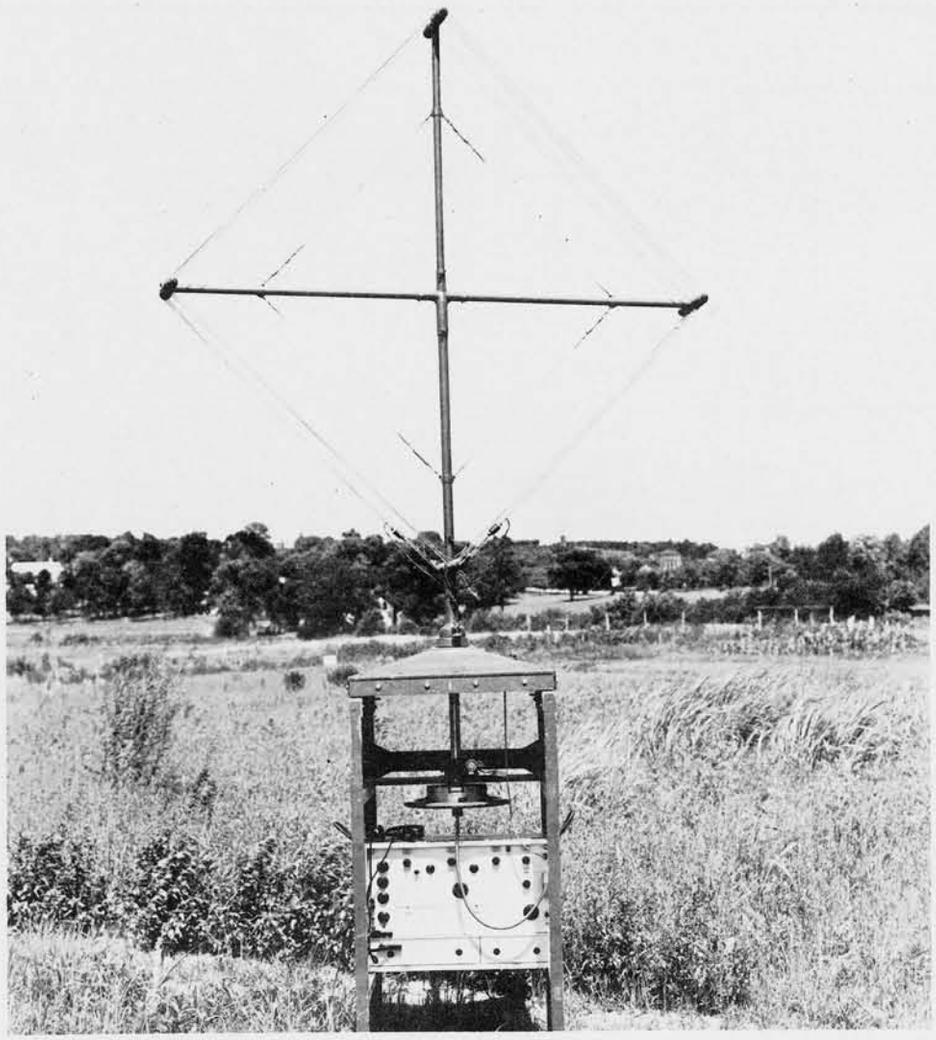
M.F. LOOP TOWER



M.F. LOOP TOWER

DIRECTION FINDER
MEDIUM FREQUENCY (CONT.)

On this page are shown examples of three different types of Japanese Medium Frequency Direction Finders.



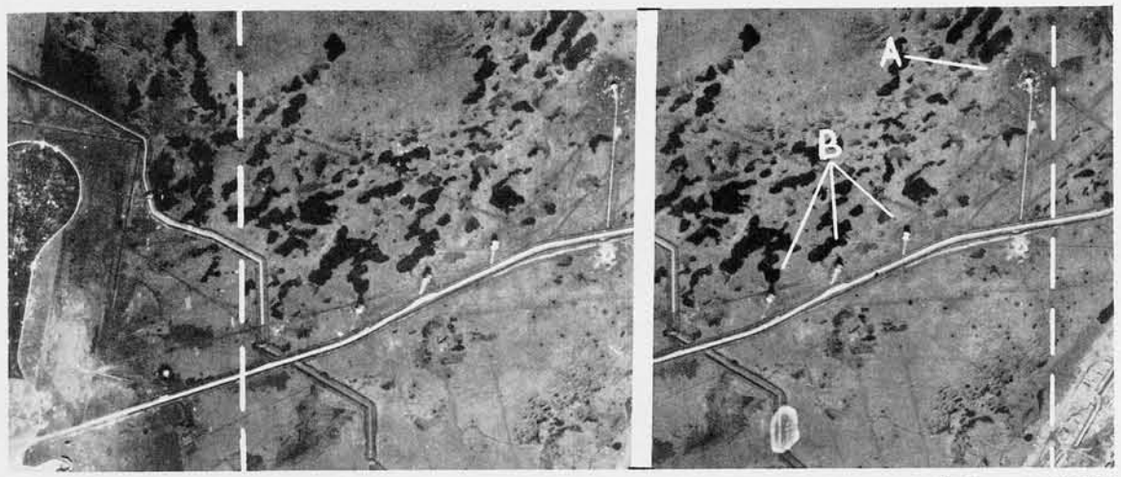
PORTABLE MEDIUM FREQUENCY D. F.

Japanese Army type Portable Medium Frequency D. F. The aerial, which measures 6 feet on the diagonal, rotates through 360 degrees. The installation is complete as shown in above photograph. Dry batteries are included with the receiver.

This D. F. is very similar to U. S. Army types of the year 1930.

The top of the antenna is 12 feet above the ground and the base is 2' x2' x5' high.

The receiver tunes between 100 and 2000 Kcs.



(R.F. - 1/10000)

KURABU CAPE

"A" - MEDIUM FREQUENCY ADCOCK D. F.
"B" - HIGH FREQUENCY D. F. TOWERS

Note that the most striking recognition features of the "Open Adcock" in this vertical compose a pattern made up of central shack, concrete anchors, and circular clearing.

M. F. LOOP

M. F. LOOP TOWER

The above pictures are of a housed Medium Frequency loop D. F. The loop is a Naval type.

CONFIDENTIAL

DIRECTION FINDING

COMBINATIONS

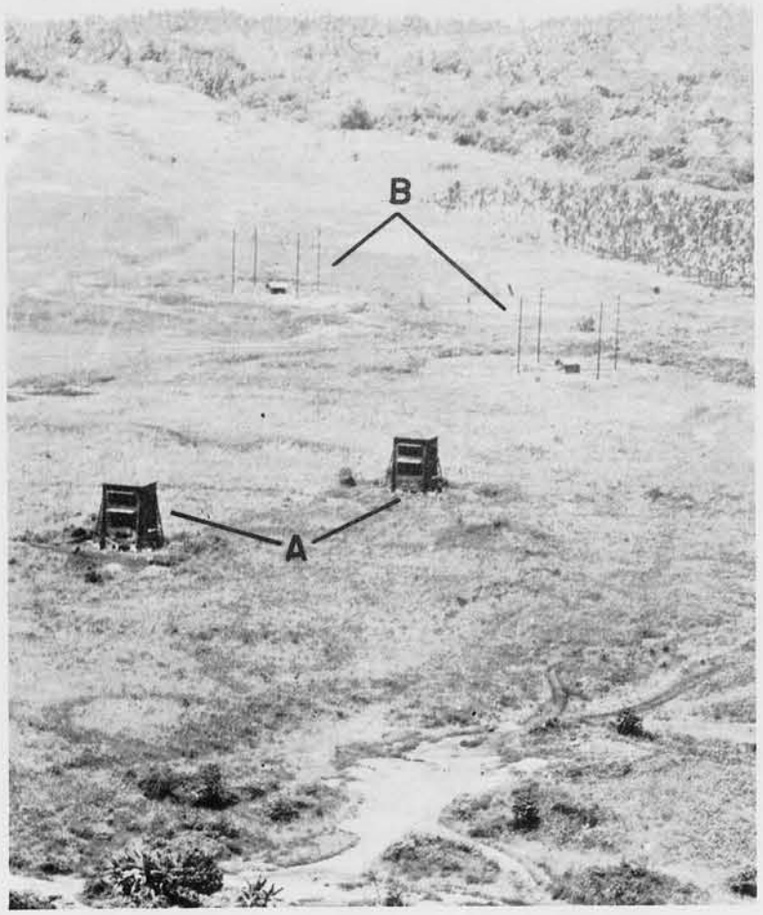
On this page is shown a typical large D.F. station, containing 3 High Frequency towers and 2 Medium Frequency setups.

Most of the identifying characteristics mentioned in the previous pages are visible here. Most Japanese airfields have D.F. stations, and they are frequently found at the end of the runway as is shown in this example.

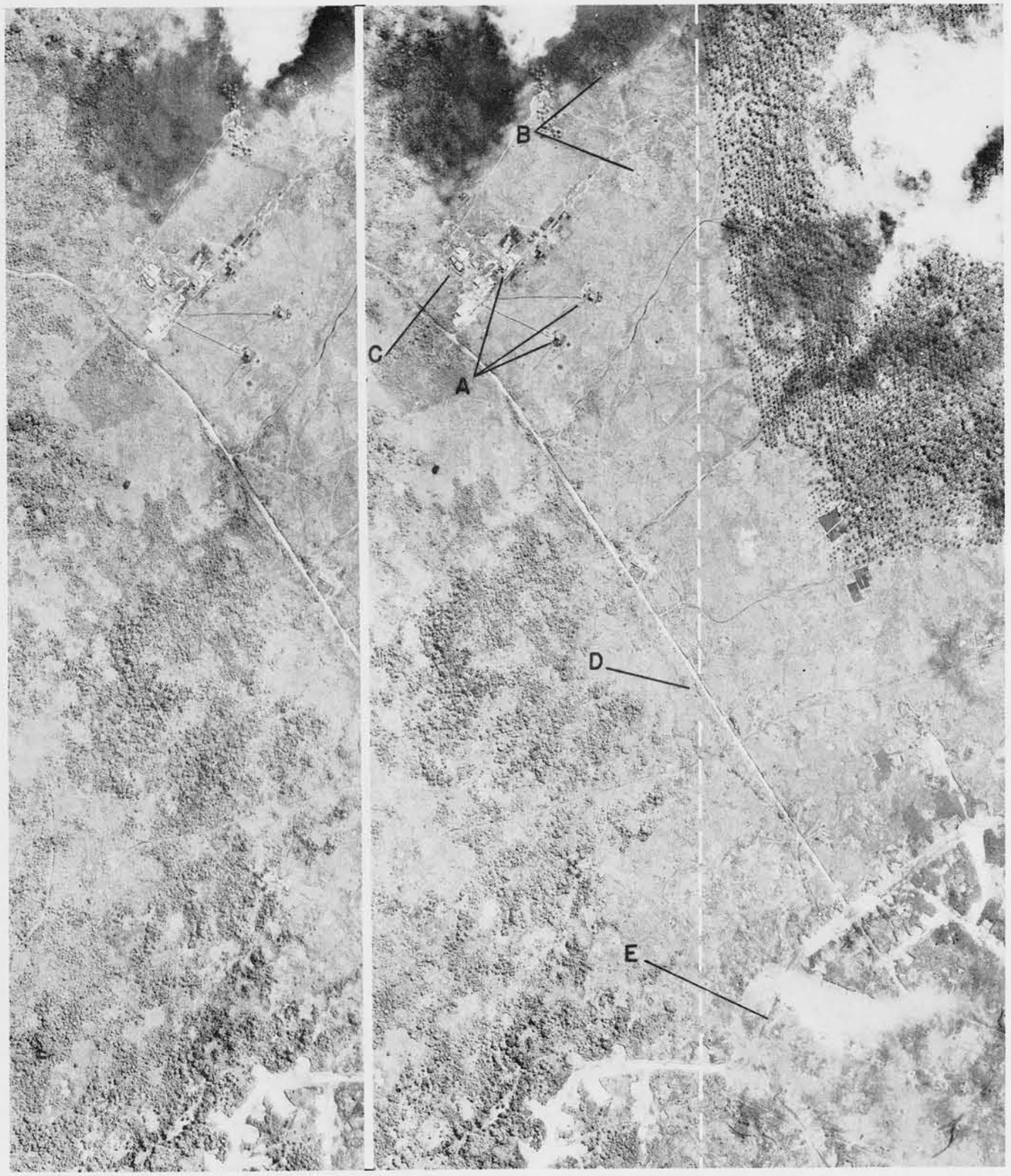
The High Frequency D.F. towers will tune between 3 to 30 megacycles per second. (3000-30000 Kcs.)

The Medium Frequency equipment will tune between 0.1 and 2 megacycles per second. (100-2000 Kcs.)

"A" High Frequency D.F.
"B" Medium Frequency D.F.
"C" D. F. Center
"D" Typical Connecting Road
"E" End of Runway.



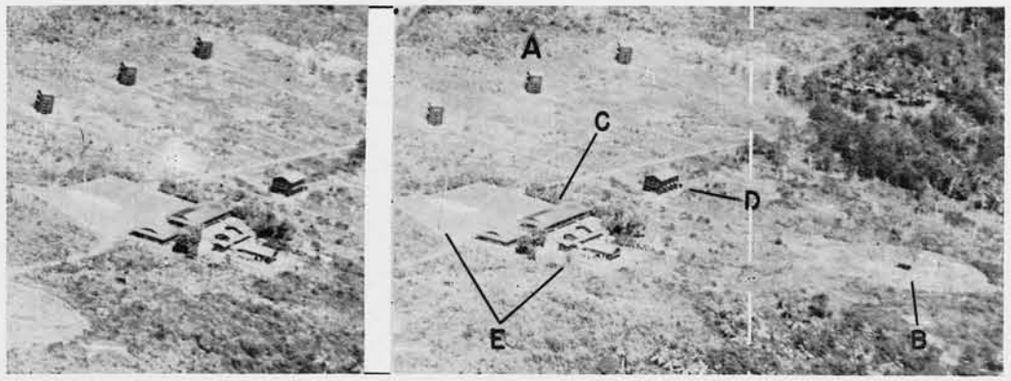
SIMPSON HARBOR, RABAUL



VUNAKANAU, RABAUL, NEW BRITAIN

(R.F. - 1/10200)

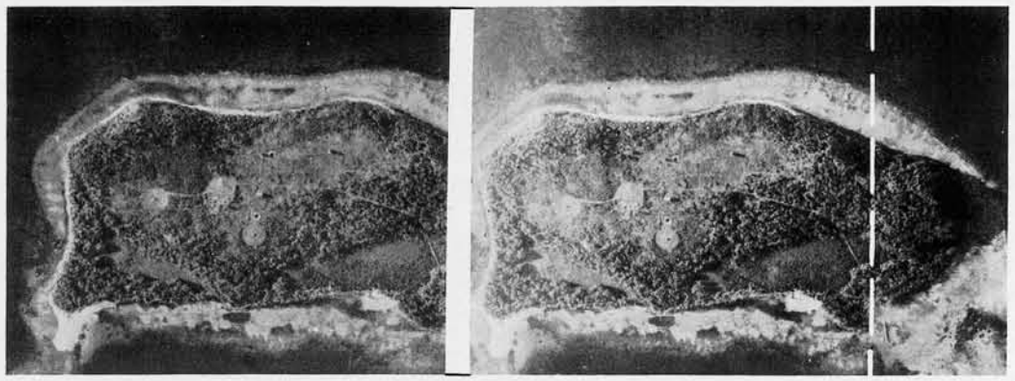
DIRECTION FINDING
COMBINATIONS (CONT.)



TRUK

Oblique stereo view of a typical large D. F. station capable of receiving at various frequencies between 0.1 and 30 megacycles per second.

"A" High Frequency D. F.
"B" Medium Frequency D. F.
"C" D. F. Center
"D" Probable Generator Building
"E" Radio Reporting Station



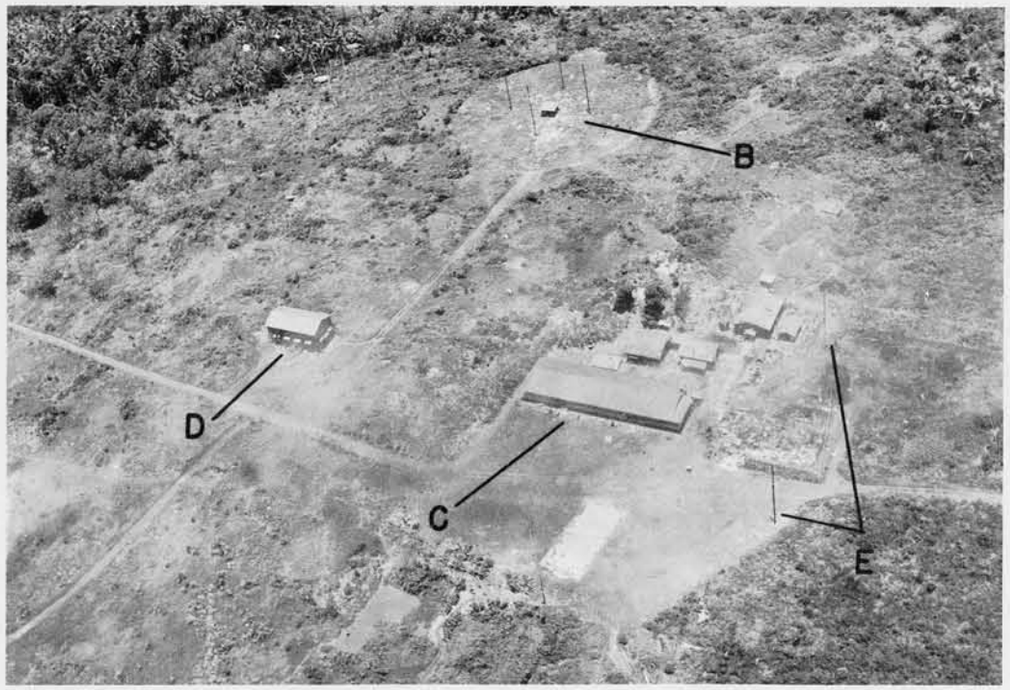
TRUK

(R.F. - 1/19700)

TRUK

Vertical stereo view of Truk D. F. center taken after considerable bomb damage has been administered. Note that identification characteristics such as concrete anchors on Medium Frequency D. F. are visible even at this small scale.

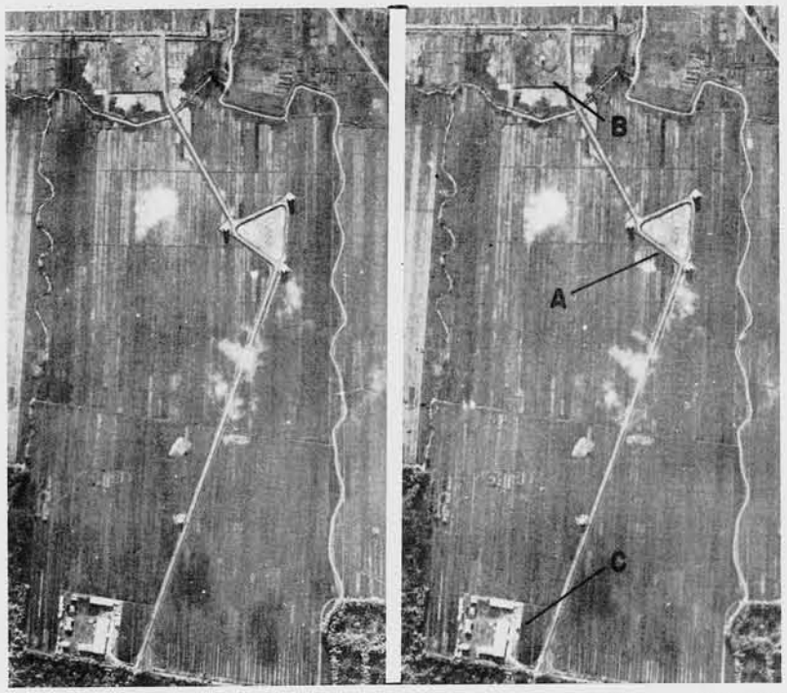
The pattern of roads and paths is an integral part of D. F. station identification. Each installation requires at least one full time operator, hence traffic lanes to all sets are imperative. The High Frequency towers here are of type "4" design.



TRUK

TRUK

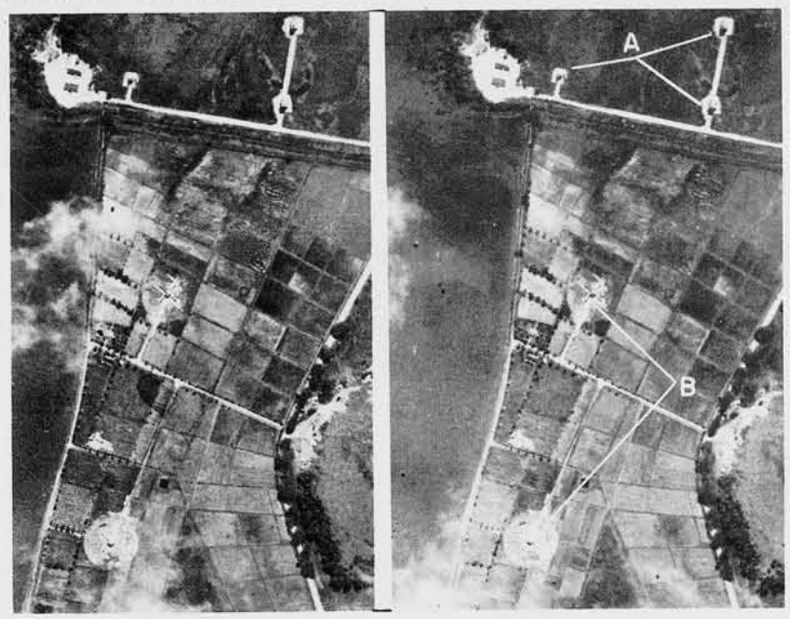
DIRECTION FINDING
COMBINATIONS (CONT.)



(R.F. - 1/10000)

SOERABAJA, JAVA

BELOW: "A" - High Frequency D.F.; "B" - Medium Frequency D.F. Two of the High Frequency buildings appear to be of the type "8" design (see summary). Although this is known to be a standard type, Chaldari is the only example shown in this report.

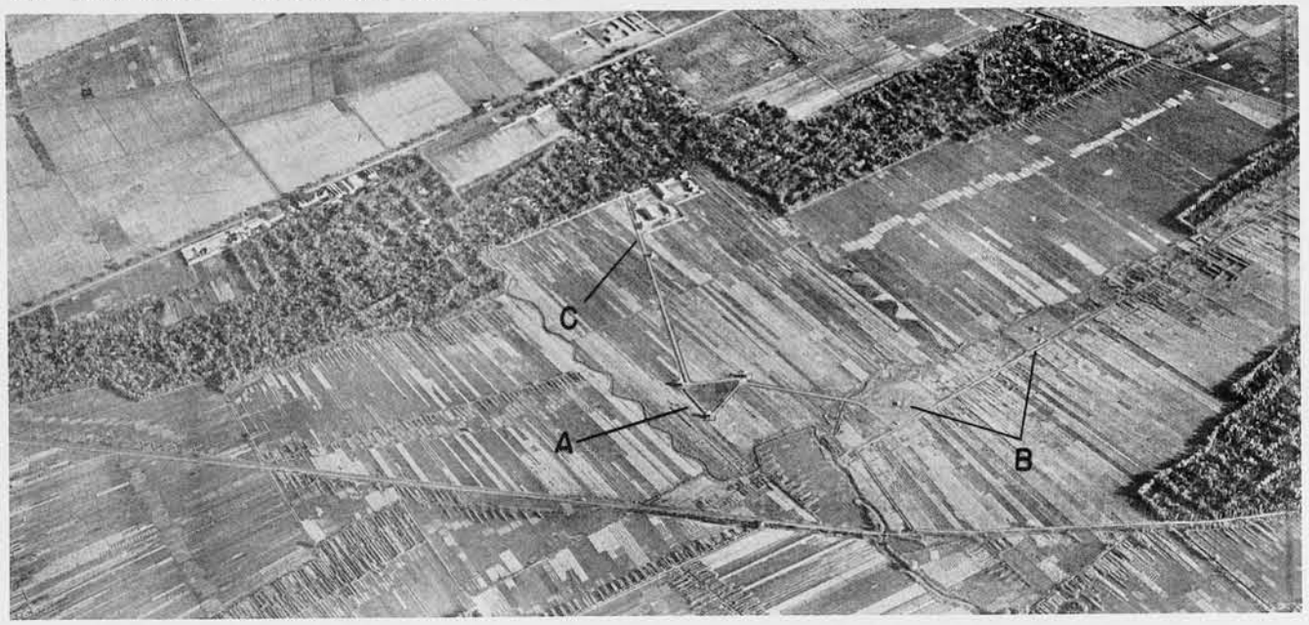


(R.F. - 1/9500)

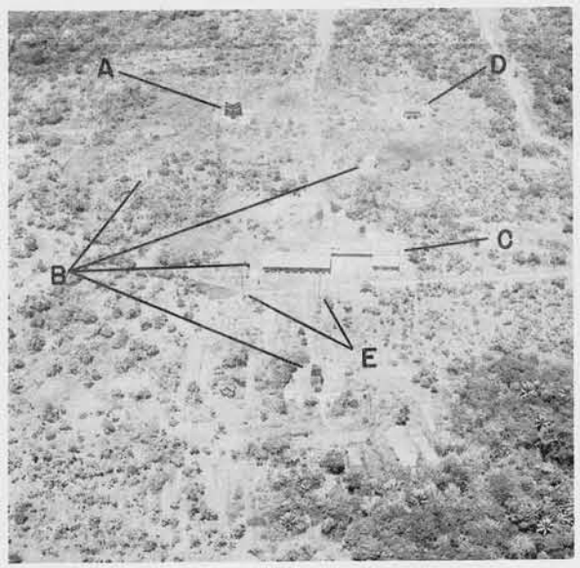
CHALDARI, SO. ANDAMAN IS.

"A" - Three High Frequency D.F.
"B" - Two Medium Frequency D.F.
"C" - D.F. Center

The towers here are arranged in an equilateral triangular pattern with 300 foot sides. The left stereo shows but one of the two existing Medium Frequency installations. The low oblique shows the entire D.F. station and its relationship to the surrounding country. Flooded areas such as rice fields, afford good sites for all types of electronics equipment.

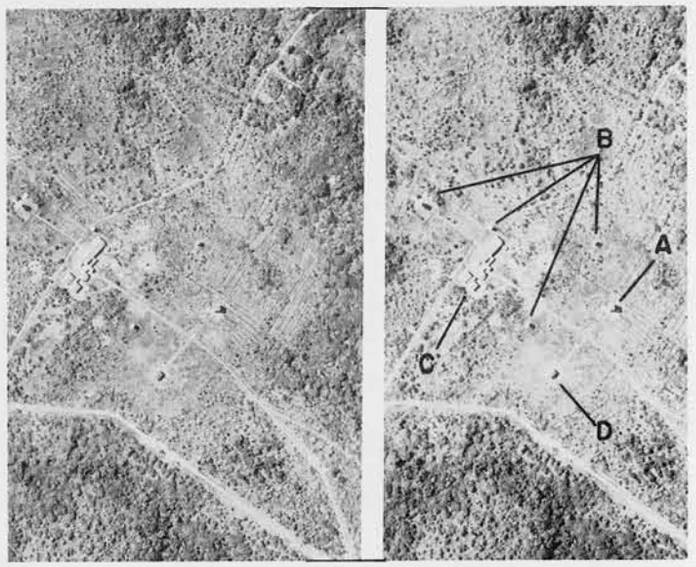


SOERABAJA, JAVA



YAP

"A" - Type "5" D.F. tower (High Frequency)
"B" - Towers, presumed to enclose loop type Medium Frequency D.F.

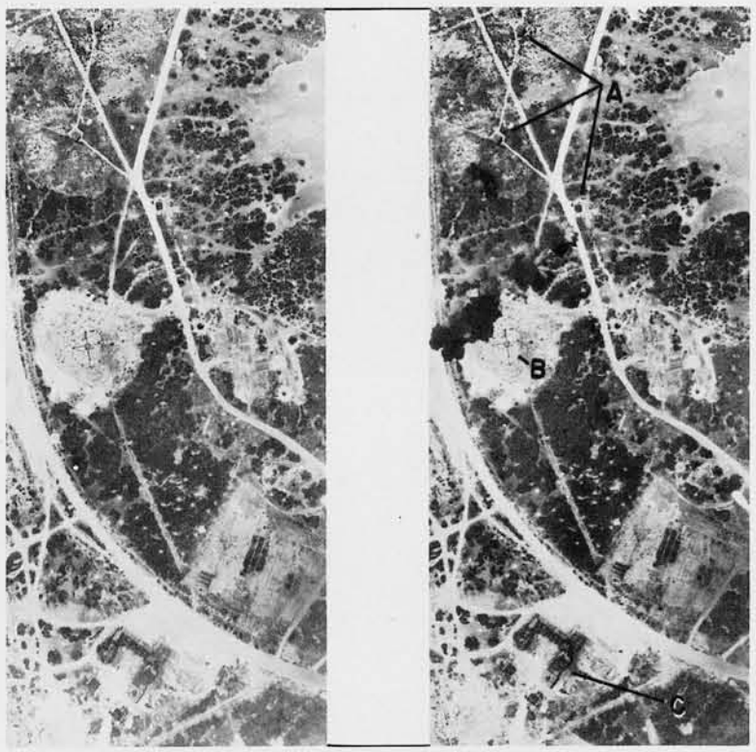


(R.F. - 1/9000)

YAP

"C" - D.F. Center
"D" - Probable Generator Building
"E" - Masts of Radio Reporting Station

DIRECTION FINDING
COMBINATIONS (CONT.)



WAKE

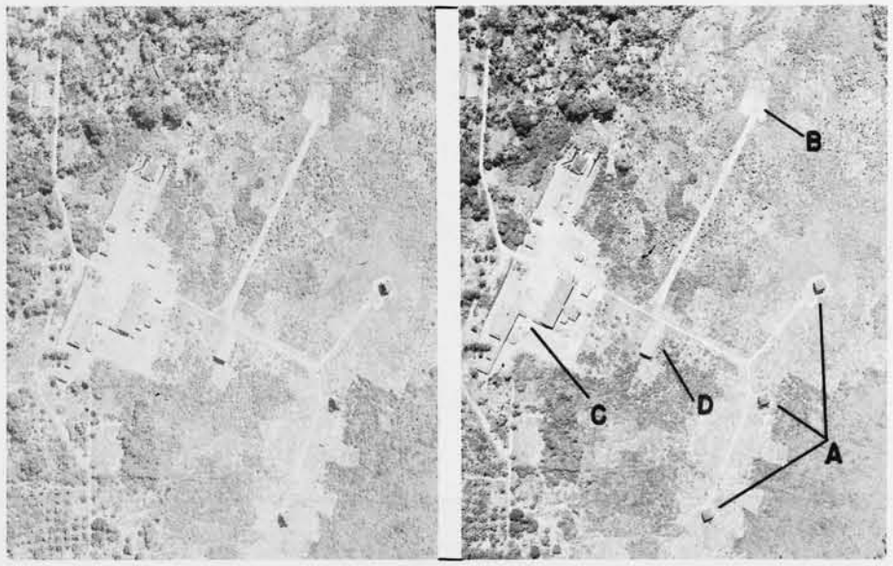
(R.F. - 1/7500)

LEFT:
D.F. center on Wake
"A" - Three type "I" High Frequency towers
"B" - One Medium Frequency DF
"C" - Attu type Radar on roof of former U.S. Bachelor Officers Quarters.

Radar is often found in conjunction with D.F. Stations.

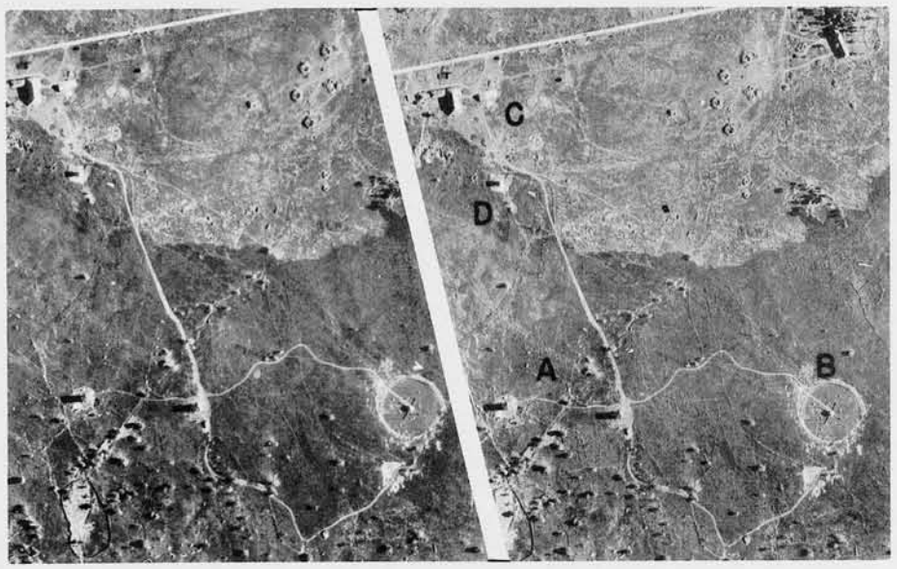
Note path and road connections to all D.F. installations

D.F. Center is probably across road to the right of Medium Frequency set.



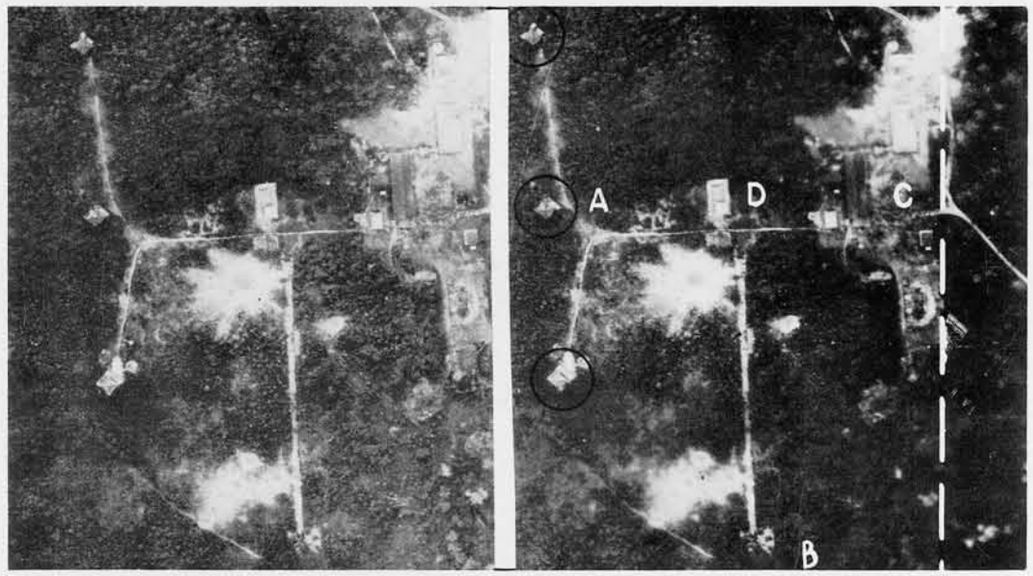
PALAU

(R.F. - 1/5000)



KOEPANG, TIMOR

"A" - TWO HIGH FREQUENCY D.F. TOWERS "B" - ONE MEDIUM FREQUENCY D.F.
"C" - D.F. CENTER WITH RADIO REPORTING STATION (MEDIUM FREQUENCY)
"D" - POSSIBLE HIGH FREQUENCY D.F. TOWER (NEWLY ERECTED - THIS DESIGN HAS NOT BEEN SEEN ELSEWHERE)



PALAU

(R.F. - 1/4000)

"A" - Three type "5" High Frequency D.F. towers
"B" - Site probably originally planned for Medium Frequency D.F.
"C" - D.F. Center
"D" - Probable Generator Building

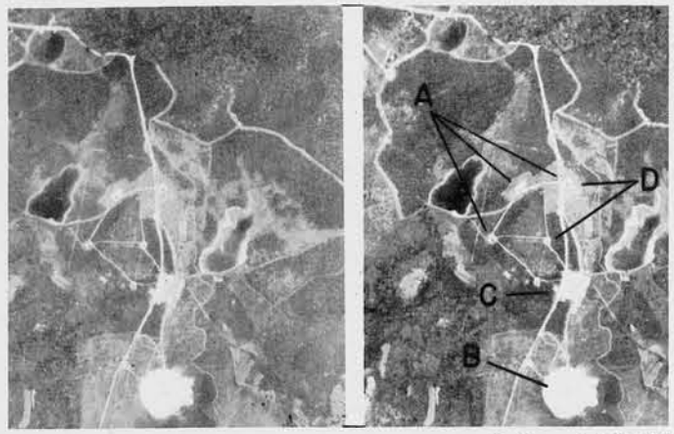
The above two stereograms of the Palau D.F. station were taken several months apart. The lower one shows considerable bomb damage and some new construction. Apparently the Medium Frequency project was abandoned.

DIRECTION FINDING

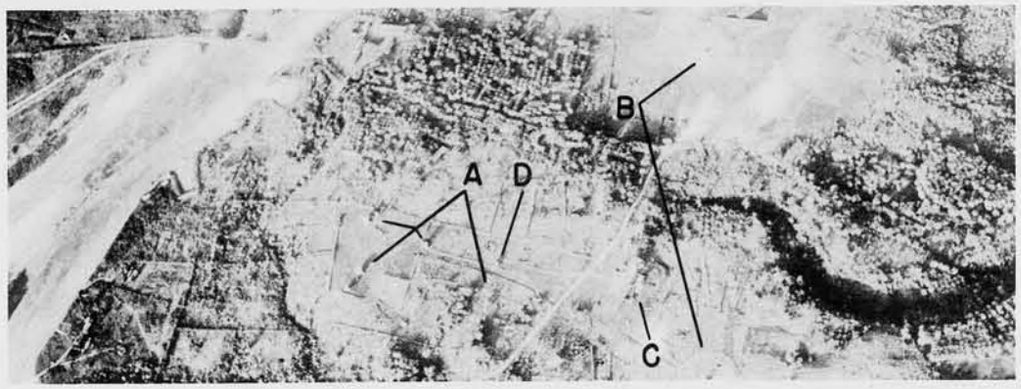
COMBINATIONS (CONT.)

This is the first conclusive proof that the Japanese style of D.F., as standardized through the Pacific islands, is also used on the homeland in the same manner.

"A" - Three High Frequency D.F. towers
"B" - Medium Frequency D.F.
"C" - D.F. Center
"D" - Probable old type Medium Frequency D.F. such as type "8"

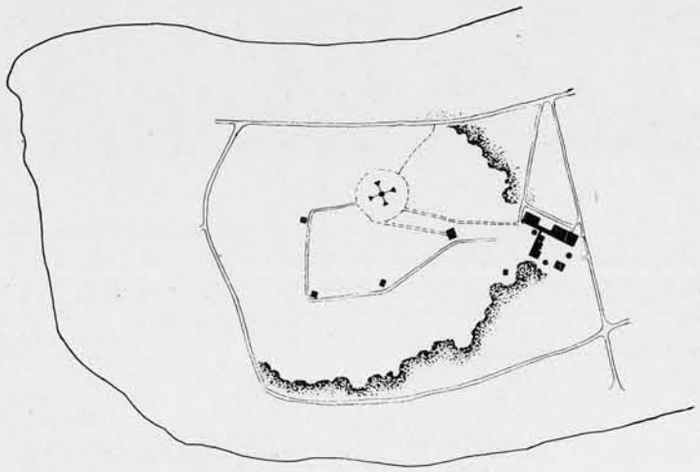


SASEBO , JAPAN (R.F. - 1/16170)

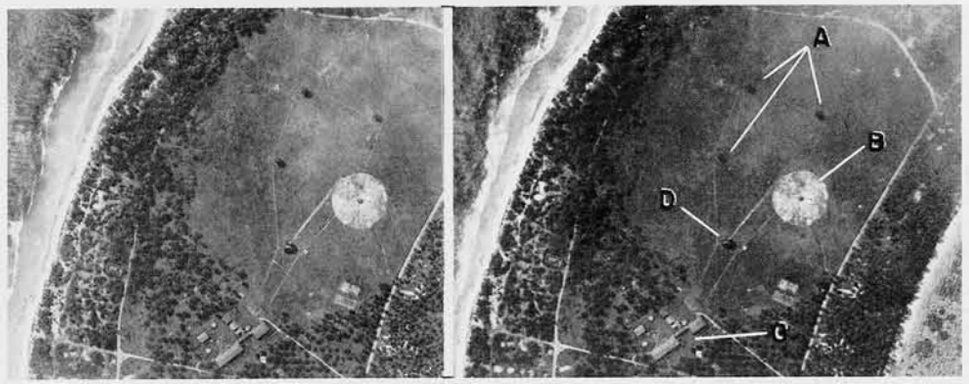


SABANG, SUMATRA

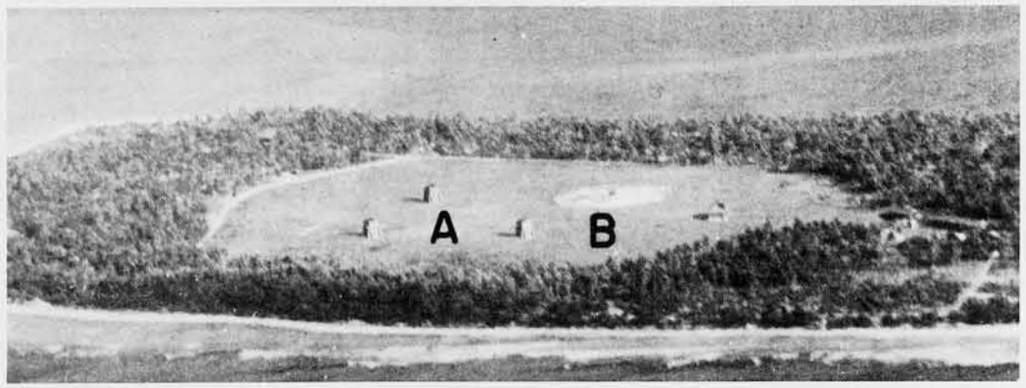
"A" - Three High Frequency D.F. towers
"B" - Two Medium Frequency D.F.
"C" - D.F. Center
"D" - One Probable High or Very High Frequency tower (low type)



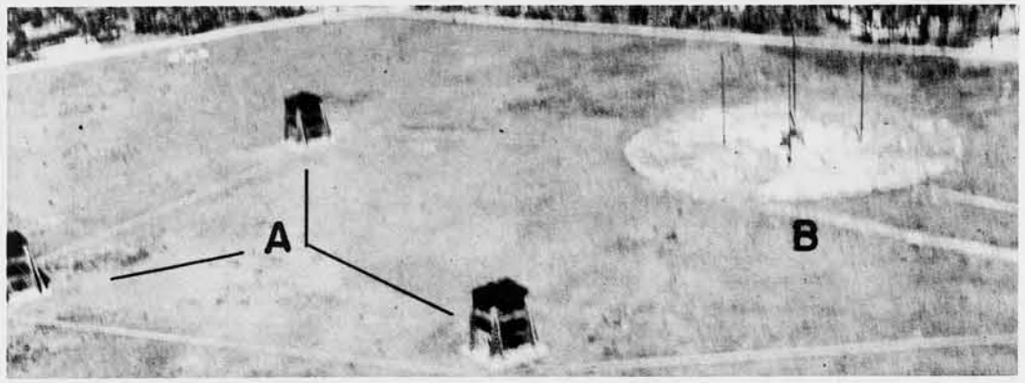
KWAJALEIN



KWAJALEIN (R.F. - 1/10000)



KWAJALEIN



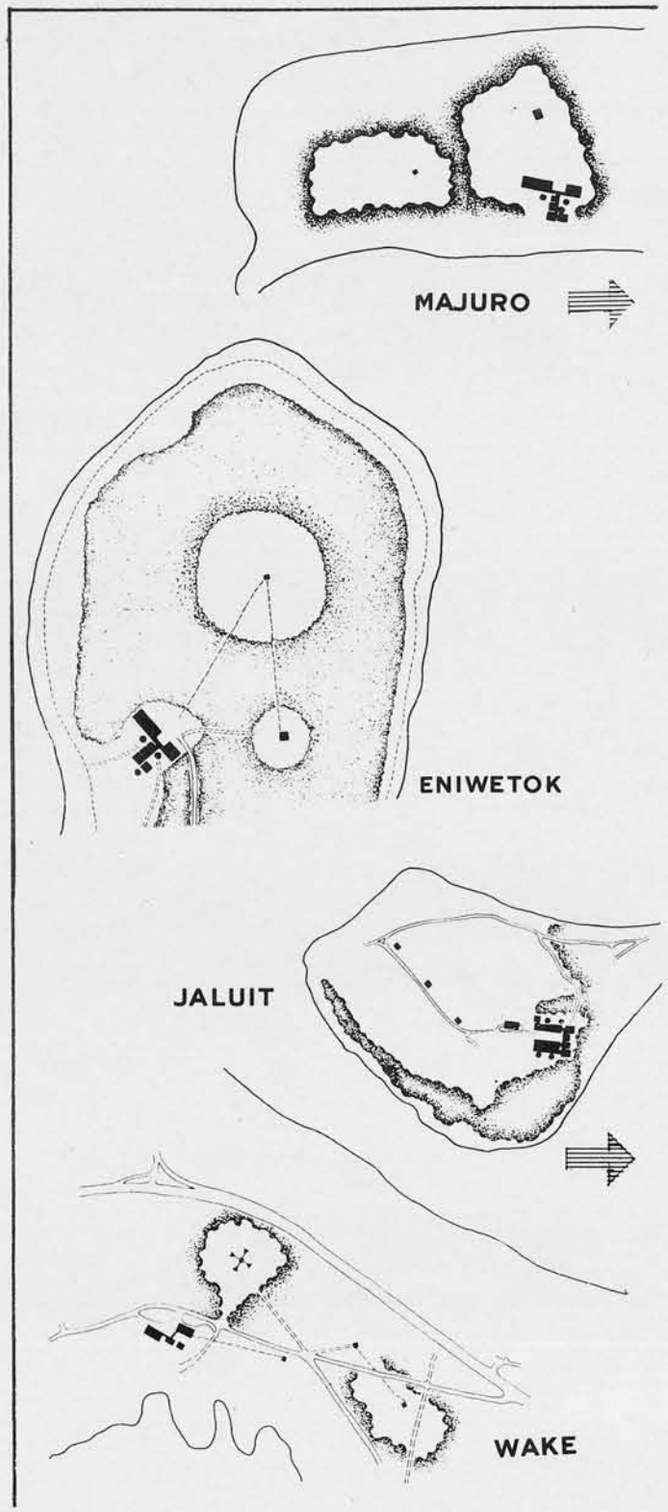
KWAJALEIN

"A" - Three type "5" High Frequency D.F. towers.
"B" - One Medium Frequency D.F.
"C" - D.F. Center
"D" - Probable Generator Building

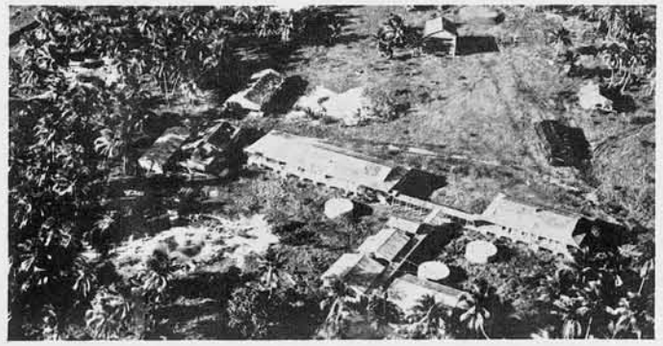
One of the first Japanese D.F. stations observed was at Kwajalein.

Note constant orientation of all D.F. installations with respect to north.

DIRECTION FINDING
CENTERS



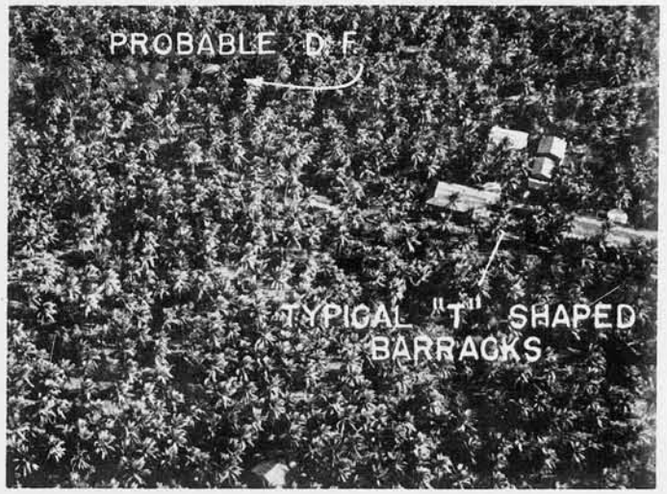
Drawings of four D. F. stations showing the similarity in pattern and location of D. F. centers.



DARRITT, MAJURO, MARSHALLS

Japanese Direction Finder Stations often include a building group which is used for communications, administration and living facilities. Such a building group is here called a "D. F. Center".

The D. F. Center is easily recognizable by its pattern and location. In plan it assumes "T", "H", or "U" shape. It is usually composed of prefabricated wooden one story units connected by narrow covered passageways.



UTIRIK

The largest elements of the building group are likely to be barracks or offices. The radio transmitter is often located at one end of the barracks building. This site should be cleared.

JALUIT, MARSHALLS

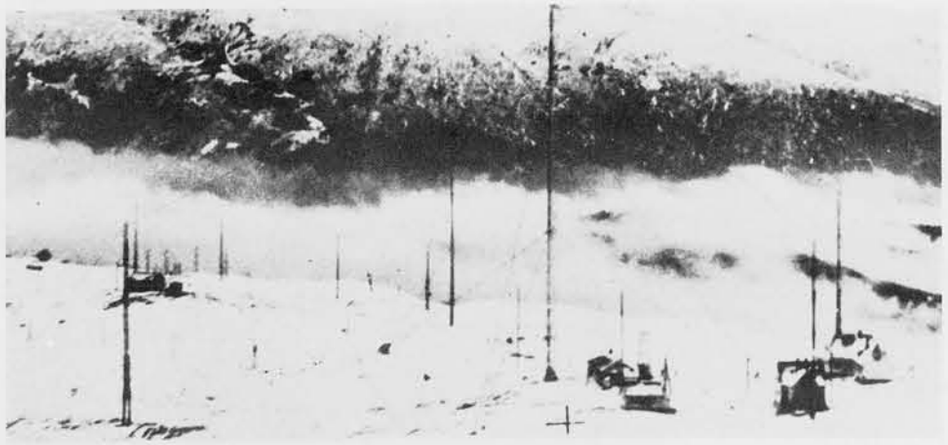
"A" - MESS HALL OR BARRACKS
"B" - LATRINE
"C" - WASH HOUSE
"D" - GALLEY
"E" - WATER STORAGE
"F" - OFFICES
"G" - BARRACKS
"H" - TRANSMITTING EQUIPMENT
"J" - UNIDENTIFIED (PROBABLY FOR GENERATING POWER)
"K" - MASTS FOR RADIO REPORTING STATION

VUNAKANAU, RABAUL, NEW BRITAIN

"A" - D. F. Center
"B" - High Frequency D. F. Tower
"C" - Mast for Radio Reporting Station

DIRECTION FINDING

GERMAN



BELLINI - TOSI

The Bellini-Tosi D.F. consists of a tall central mast surrounded by four short masts which support aerials slung from the central mast. Since these feeds are above ground, no cross pattern is visible. The hut is slightly off center due to position of central mast. This is a loop type D.F.

MEDIUM FREQUENCY ADCOCK

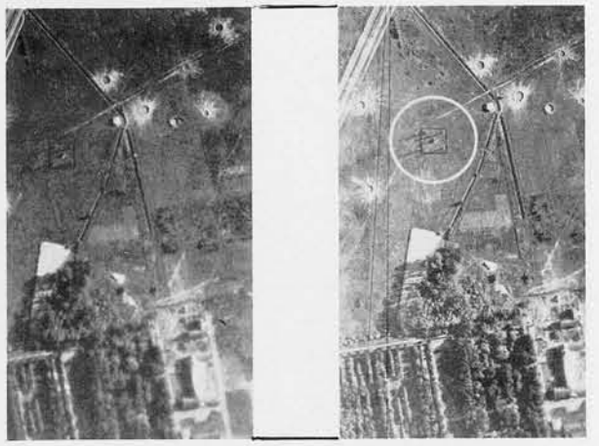
Identifying characteristics of the German Adcock are clearly visible in this low oblique: Four masts in square, central hut, and square fence enclosure. Mast on hut is a central sensing antenna and is frequently visible. White scar leading from outside fence is buried power cable.

Note that the mast is a more elaborate design than on Japanese Adcocks.

There are two types of Direction Finders used by the Germans, the Adcock and the Bellini-Tosi. The Adcock type is the more generally used.

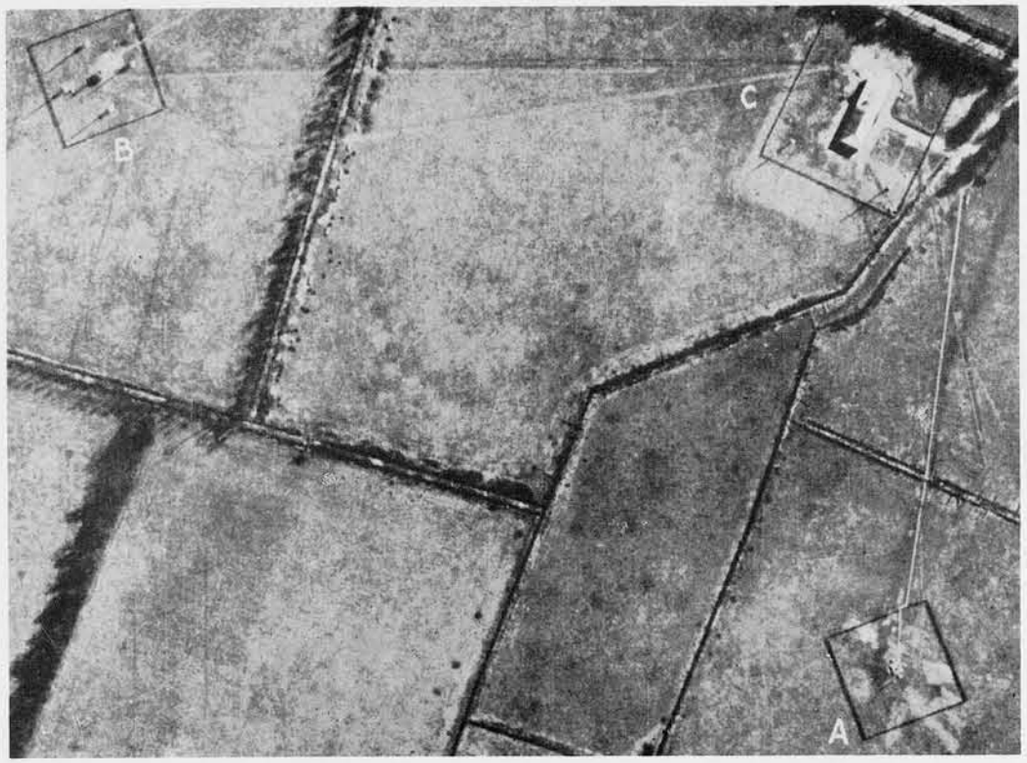
RIGHT: German Medium Frequency Adcock D.F. resembles the Japanese type, except for the well standardized use of a square fence (or wall) enclosure around the installation. This is strongly visible in aerial photographs, as is the circular clearing around the Japanese "Open Adcock".

The buried feeds create cross shaped ground scars of equal length and with arms usually lying in N.,E.,S., and W. directions.



GERMANY (R.F. - 1/10000)

MEDIUM FREQUENCY ADCOCK



HIGH AND MEDIUM FREQUENCY ADCOCKS VILLERS, FRANCE

"A" - German High Frequency Adcock. Diagonal spacing between unipoles is about 30 feet.

"B" - German Medium Frequency Adcock. Diagonal spacing between unipoles is about 100 feet. note shadow of central sensing antenna, which is seldom visible in Japanese installations.

"C" - Headquarters building including radio reporting station. Scars leading out from this building are buried power lines.

DIRECTION FINDING
GERMAN (CONT.)

German Pylon Stations are used in connection with Aircraft Control. They consist of a Benito D.F. and a Benito Transmitter (do not confuse with Benito Navigational Aid) and a plotting hut.

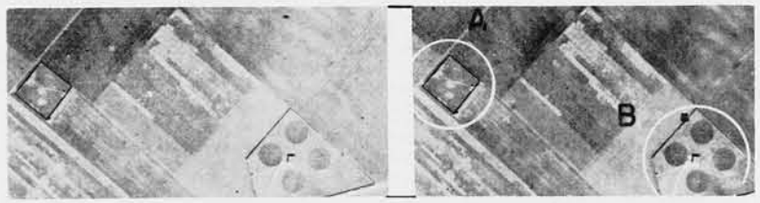
They function as follows: The rotating Adcock type D.F. (mounted on the pylon) receives signals from the aircraft at 38.4-40.4 mcs. Information on range and bearing thus received goes to the plotting hut. Instructions emanating from here are relayed to the transmitter hut which sends same back to the aircraft at 40.4-42.3 mcs.

The Pylon is about 65 feet high and the transmitter mast is about 90 feet high.

The typical Medium Range Benito station contains five D.F. pylons and five transmitters, all operating on slightly different frequencies for simultaneous control of five different aircraft.

There is a "short range" Benito set (not shown here) which is found on G.C.I. sites. It is similar but much smaller, the pylon and transmitter masts being but 25 feet high.

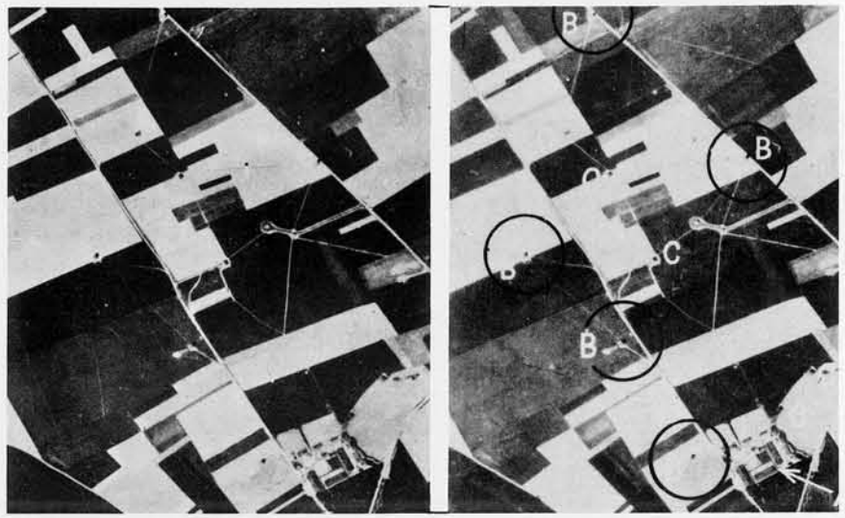
PYLON STATIONS A. "T" hut, B. Pylons, C. Transmitter huts.



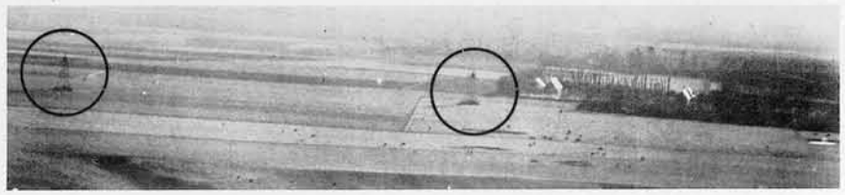
(R.F. - 1/4500)

ADCOCK D.F.'S

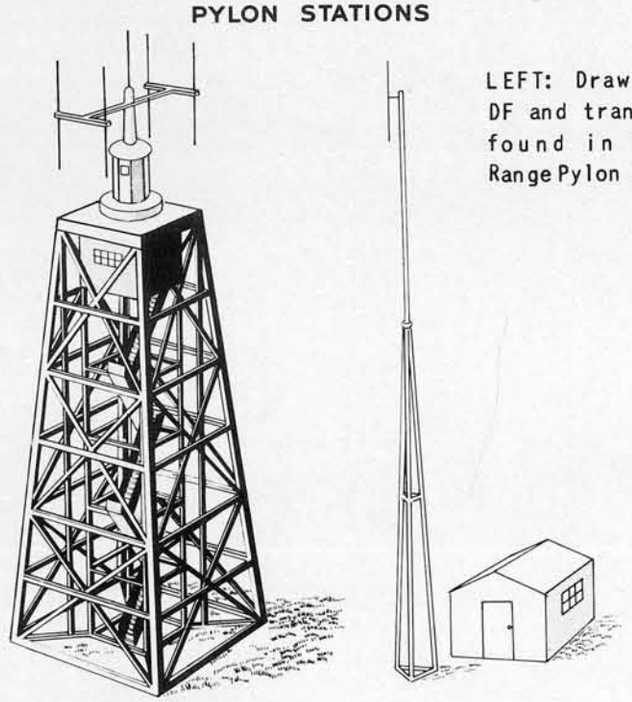
Left: "A" - Medium Frequency, "B" - High Frequency. Both of these installations are of the fixed Adcock type. Note that High Frequency collectors are in the open rather than housed, as in Japanese types.



PYLON STATIONS A. "T" hut, B. Pylons, C. Transmitter huts.



PYLON STATIONS



LEFT: Drawings of DF and transmitter found in Medium Range Pylon Stations

MEDIUM RANGE BENITO D.F. RECEIVER PYLON

MEDIUM RANGE BENITO TRANSMITTER HUT AND MAST

SUPPLEMENTARY MATERIAL

SUPPLEMENTARY MATERIAL

SUPPLEMENTARY MATERIAL